

WINGS OF AGRI-INNOVATIONS

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Foreword

It gives me immense pleasure to present the book 'Wings of Agri-Innovations' which is a comprehensive overview of the meticulous efforts of the institute, leading to generations of numerous IPRs in various sectors of agriculture.

The book depicts the role of ZTM & BPD Unit in the protection and maintenance of intellectual property rights (IPRs) developed by Indian Agricultural Research Institute, and licensing of these technologies. In this book, the reader is also apprised of the inspiring journey of the 'IP Spectra- An Intellectual Property Facilitation Centre (IPFC) for Agro-based MSMEs' in encouraging intellectual property protection of the technologies developed by MSMEs and Start-ups.

The authors of this book have done a remarkable job by systematically and promptly composing the contents of the book. I am confident that the readers will find this book highly engaging and inclusive of all the work of the ZTM & BPD in IP management.

Thank You,

Dr. A.K. Singh

(ASHOK KUMAR SINGH)



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Preface

As a general viewpoint, the value of novel innovations in today's world is still not considered enough to be protected by a suitable statutory body, for reaping its fruits in the times ahead; primarily due to lack of awareness about the significance of Intellectual Property Rights (IPRs). However, in a recent shift, all nations are now working their best to generate awareness about IPRs & impart knowledge to its citizens.

In the highly competitive era of research & development and commercialization, every enterprise strives to reach great heights in terms of gaining market traction or luring investors/venture capitalists. Similarly, in the academic and other institutions where the research takes place for the benefit of the public, it has been noted many times, that the products don't get to reach the market place due to non-timely Intellectual Property protection.

India Innovation Index (III), 2019 which was released by NITI Aayog on October 17, 2019, summarizes the innovative efforts put by each state of India, individually. The government has launched many schemes like Start-up India, scheme to support 'IPR Awareness Workshops/ Seminars' for sensitizing and generating awareness about Intellectual Property Rights among various stakeholders especially in E&IT sector, scheme for IPR Awareness – Creative India, Innovative India, etc. to boost IP awareness, IP filings and registrations by its nationals.

National Intellectual Property Rights (IPR) Policy, 2016 was a landmark step by the government to lay the future roadmap for IPRs in India. Over a period of time, the Indian Council of Agricultural Research (ICAR) has advanced its operations in the translation of research inputs into rewarding outputs with the help of protection of their research outcomes with suitable ways of IP protection. Indian Agricultural Research Institute (IARI), administered by ICAR is a premier institute of agricultural research, education and extension. It has been a front- runner in protecting the intellectual properties conceptualized by its scientists under the aegis of Zonal Technology Management & Business Planning and Development Unit, ICAR-IARI, formerly known as ITMU. The aim of the Unit is to encourage, protect, market and license the technologies developed by scientists of IARI, to the industry with a focus on the incubation process including Start-ups and Farmer Producer Organizations (FPO).

This book is an emulation of the achievements of ICAR in terms of thorough protection and maintenance of IPRs created by the Indian Agricultural Research Institute. The reader shall obtain a comprehensive overview of the meticulous efforts of IARI, leading to generations of numerous IPRs in various sectors of agriculture.



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Acknowledgements

This book is a sincere effort to present the intellectual properties managed and owned by the Indian Council of Agricultural Research (ICAR) due to the diligent hard work of the Indian Agricultural Research Institute (IARI). This book encapsulates the building of an effective mechanism of IP management by the Institute and its favorable outcomes during the journey.

To begin with, we owe our sincere thanks to Dr. A. K. Singh, DDG (Agricultural Extension) & the then Director (Actg.), ICAR-IARI for the encouragement and support in giving this book a final form. We are grateful to Dr. A. K. Singh, Director, ICAR-IARI for his all-round support, directions and suggestions in bringing out this publication, as well in writing different chapters of the book.

We extend our gratitude to IP&TM Division, ICAR in lending their support towards the management of IPRs of the Institute, without which the foreign IP filings would not have been possible. We are also humbled by the valuable feedback and insights provided by Dr. Malvika Dadlani, Fmr. Joint Director (Research), ICAR-IARI in the due course of development of contents of this book.

We would also like to thank our dedicated and supportive team of ZTM & BPD Unit in putting their strenuous efforts in bringing this book to completion. Last, but not the least, our humble gratitude to the Almighty for guiding us to correct paths and showering his blessings on us in fulfilling our goals.

Happy reading!





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Chapters	Title	Page No.
Chapter 1	Intellectual Property Management at Public Research Institutions	1
Chapter 2	Intellectual Assets of ICAR-Indian Agricultural Research Institute	7
Chapter 3	Detailed Biography of Granted Patents of Agri-Innovations	39
Chapter 4	Afterword	103

Tables

Table No.	Title	Page No.
1.1	List of IP Services Provided by IP Spectra	5
2.1	List of Patent Application Filings and Patent Grants from 1950-2020	7
2.2	Commercialization status of filed Patent Applications and Granted Patents of IARI	23
2.3	Plant Variety Application Filings and Registration details during 2011-2019	25
2.4	Trademark Filings and Registration details of Logos of IARI during 2005-2019	32
2.5	Trademark Filings and Registration details of Word marks of IARI during 2005-2020	32
2.6	Trademark Filings details of Well-Known marks of IARI from 2005-2019	33
2.7	Copyright Filing and Registration details during 2011-2020	35
2.8	Patent Application Filing details from 2017-2020	36
2.9	Trademark Application Filing details from 2017-2020	37
2.10	Copyright Registration details	37

Figures

Figure No.	Title	Page No.
2.1	Patent filing trend from 1950-2020	20
2.2	Domain-wise percentage of patent application filings from 1950-2020	21
2.3	Domain of filed patent applications vs. decades of filings	22
2.4	Decade-wise distribution of granted patents	22
2.5	Plant variety applications filed during 2011-19	25
2.6	Registration of PPVFRs during 2012-2019	29
2.7	Cropwise share of major crops granted PPV&FR Registration	30
2.8	Status of licensing of various plant varieties	31

Abbreviations

1. AgIn: AgriInnovate India Ltd.
2. ATMC: Agro-Technology Management Centre
3. BPD: Business Planning and Development
4. CBD: Convention on Biological Diversity
5. IARI: Indian Agricultural Research Institute
6. ICAR: Indian Council of Agricultural Research
7. IPFC: Intellectual Property Facilitation Centre
8. IPM: Intellectual Property Management
9. IPR: Intellectual Property Rights
10. ITMU: Institute Technology Management Unit
11. ITMC: Institute Technology Management Committee
12. ITPGRFA: International Treaty on Plant Genetic Resources for Food and Agriculture
13. MSME: Micro Small & Medium Enterprises
14. NAIP: National Agricultural Innovation Project
15. PPVFR: Protection of Plant Varieties and Farmers' Rights
16. SAUs: State Agricultural Universities
17. TRIPS: Trade-Related Aspects of Intellectual Property Rights
18. TOT: Transfer of Technologies
19. TT: Technology Transfer
20. ZTMC: Zonal Technology Management Centre





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CHAPTER 1

Intellectual Property Management at Public Research Institutions

Intellectual Property Rights (IPR) have become crucial in the fast changing and emerging scenario of trade environment, which is characterized by evolving and ever-changing global competition, high innovation risks, small product cycles, necessity for rapid and continuous technology changes and improvements, growing needs for investments in research and development (R&D), production, marketing and demand for highly skilled human capital.

Hence, IP management at the research and academic institutions becomes an essential tool to protect their scientific research, technologies and innovations created out of collaborative and/or consultancy projects, along with the innovation within the institutions which are commercialised through licensing and partnerships.

IP management at research institutions and universities relates to protecting every form of intellectual property generated as a result of research including inventions, technologies, databases, publications, software, algorithms, branding and logos etc.

Good IP management practices are not limited to protecting the various intellectual properties, but also involves developing human resources trained in IP management skills.

Intellectual Property (IP) Management at ICAR- Indian Agriculture Research Institute

IP management practices at ICAR-IARI have evolved incessantly according to the changes in the policies at institutional and national levels. The IARI now holds structured and well laid down IP management protocols and guidelines for the protection of various forms of intellectual properties generated by the institute. It is based on the IPR framework of the ICAR as laid down in its ¹"Guidelines for IP Management and Technology Transfer Commercialization", which are in conformation to the current national IPR laws and policies, legal framework of ²TRIPS Agreement, provisions of the ³Convention on Biological Diversity (CBD) and the International Treaty on Plant Genetic Resources for Food and Agriculture ⁴ (ITPGRFA). Utmost efforts are being made continuously for the harmonization of the new guidelines and / or amendments, if any, with the related national and international laws and relevant norms through reviews, revision and reassessment.

1. ICAR, 2018. ICAR Guidelines for Intellectual Property Management and Technology Transfer/Commercialization (Revised in 2018) Indian Council of Agricultural Research, New Delhi.

2. The WTO's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), negotiated during the 1986-94 Uruguay Round, introduced intellectual property rules into the multilateral trading system for the first time.

3. The Convention on Biological Diversity (CBD) is the international legal instrument for "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources" that has been ratified by 196 nations. It entered into force on 29 December 1993.

4. International Treaty on Plant Genetic Resources for Food and Agriculture; Food and Agriculture Organization of the United Nations. The objectives of the International Treaty on Plant Genetic Resources for Food and Agriculture are the conservation and sustainable use of all plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, in harmony with the Convention on Biological Diversity, for sustainable agriculture and food security.

"Owning the intellectual property is like owning land: You need to keep investing in it again and again to get a payoff; you can't simply sit back and collect rent."





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Three-Tier IP Management Mechanism at ICAR

In 2006, ICAR launched its key IP management policy elements together with well-versed guidelines for “Intellectual Property Management and Technology Transfer/ Commercialization (IPM&TT/C)”. Under these guidelines, commercial ethos in the transfer of skills and products were institutionalized through the following three-tier IP management mechanism in each one of its institutes:

- 1) Agro-Technology Management Centre (ATMC) at ICAR level;
- 2) Zonal Technology Management Centres (ZTMC); and
- 3) Institute Technology Management Units (ITMU)

This 3-tier mechanism ensures a decentralized and empowered system with handholding opportunity for other institutes by the ZTMCs, an upward-downward back and forth decision support, capability for commercialization and public-interest decisions in technology transfer (TT). The ICAR keeps all IP assets and maintains relevant records related to IP, TT and commercialization in various ICAR institutions.

ATMC serves as the apex unit, which facilitates, coordinates and monitors the implementation of IPR and TT policies across the ICAR establishments. ZTMCs handle pre-defined zones through their Business Planning and Development (BPD) Units and have regional roles in managing ICAR’s IP and TT activities. The ITMUs, created in each ICAR institute is headed by the institute’s director and provides decision-making support system through the respective ITMCs. Researchers at ICAR institutions are encouraged to disclose their inventions to ITMU, which evaluates the novelty of the research, patentability of the invention or respective criteria of other IPR protection (e.g. plant variety protection, trademark, design protection, etc.) and pursues the process of IPR protection and maintenance, accordingly.

Academia - Industry Cooperation at ICAR-IARI: Public-Private Partnership

In the Indian Council of Agricultural Research (ICAR), collaboration with industry was conceptualised in the late 1980s and sporadic transfer of technologies (TOT) began to take place. A business cell was established in IARI and the transfer of technologies started through NRDC in the late 90s. However, the most vital technologies emerging from the institute were the new improved plant varieties, hybrids and their parental lines, which were freely available to all till the implementation of the PPV&FR Act in the country. With time, the new trends of globalization in trade and intellectual property protection have enabled ICAR institutes and State Agricultural Universities (SAUs) to build adequate capacity/ facilities for the conceptualization, development, licensing and commercialization of new technologies and products, thereby instilling a culture of Intellectual Property (IP) protection.

Specific policies and guidelines have been laid down by the ICAR to enable its institutions to work with private partners for consultancy and collaborative research and technology development. Additionally, policies have also been formulated for IP ownership and licensing, Right Sharing Core Research Facilities, ICAR students as interns in the private sector and deputation of ICAR scientists/ innovators to the industry.

ZTM & BPD Unit at IARI: Nurturing & Protecting Agri Innovation

As a result of the proactive role of the ICAR in managing its technologies across all its institutes in India and creation of Zonal Agro-Technology Management Centres (ZTMC) at the zonal level to support respective institutes, there has been a remarkable progress in the protection of agri innovation. This initiative led to the establishment of ten such units across India till date, based on specific subject areas.



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For crop science based technologies, Zonal Technology Management Centre (ZTMC) was established at the Indian Agricultural Research Institute (IARI), a premier agricultural research and teaching institute, recognized as the seat of the epochal green revolution in India. Later, a new component of Business Planning and Development (BPD) was added to it under the National Agricultural Innovation Project (NAIP) of ICAR. This led to the constitution of the ZTM and BPD Unit of IARI in 2009. It diligently handles IP protection and technology commercialization at IARI, along with other zonal institutes. Commercialization of protected technology through public-private partnership models is also under its ambit. The Unit further provides services for agribusiness incubation (ABI) activities and performs a mentorship role for agriculture innovators.

The establishment of the ZTM& BPD Unit at IARI resulted in several positive outcomes in the context of the protection of agricultural innovation and their commercialization. With regards to its first function, namely- IP acquisition and protection, it has been facilitating appropriate protection of all technologies created by the ICAR-IARI scientists. This process starts right from the stage of advisory services to all scientists and researchers of IARI. There are proper mechanisms in place for meeting the scientists and researchers, understanding their technology, suggesting the most suitable form of IP for their technology’s protection, and then guiding the scientists and researchers through the process of acquiring the most suitable form of IPRs for protection of their knowledge assets.

Secondly, the ZTM and BPD Units are also actively engaged in technology commercialization by evaluating the IP assets and identifying the potential licensees for particular technologies, whether the potential licensees be the micro, small or medium enterprises or even large enterprises. The technologies are then transferred via non-exclusive licenses. As per the ICAR Guidelines, 2018, the technology commercialization role has now been transferred to Agrinnovate India Ltd (AgIn), incorporated under the Companies Act, 1956 (No. 1 of 1956) on 19th October 2011. It acts as an effective interface between Indian Council of Agricultural Research (ICAR- an autonomous organization under DARE) on one side and on the other the stakeholders of agricultural sector (farmers; public and private sector firms; R&D organizations; educational institutions- all of these at National and International level) for all important purpose of securing, sustaining and promoting global agricultural development.

Thirdly, the ZTM & BPD Unit is actively performing the nurturing role of the business incubators as well. As an incubator, *Pusa Krishi* was set-up in the Unit itself, nurturing Agri start-ups by providing curated and mentor-driven trainings on the aspects of managing and growing businesses, IP protection, market support, pilot opportunities, etc. To promote this culture of innovation and consequently to ensure employment generation and economic prosperity, the ZTM & BPD Unit offers furnished office and lab spaces, and specialized equipment to incubates, as shared resources within the incubator. *Pusa Krishi* is contributing significantly in the creation of a robust entrepreneurial ecosystem in the country in consonance with the mandate of ‘Start-Up India’ and ‘Make in India’ programs of the Government of India.

Creating a Culture of Intellectual Property Management: The Early Milestones for Technology Commercialization

Performing these crucial roles, ZTM and BPD Unit of IARI has made remarkable advances in a short span of time. IARI has filed a total of 127 patent applications from 1950 to 2020 of which 70 patents have been granted. Likewise, 61 plant variety registration applications were filed and 37 have been registered. In the context of trademarks, 26 trademarks applications were filed through the efforts of IARI, which include 2 well-known marks and among them 13 trademarks have been registered. Regarding copyrights, 8 copyright applications have also been filed by the Unit, of which 7 have been registered. It is a creditable indicator of the immense potential for IP acquisition and commercialization in the area of agricultural innovation.



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Training and Awareness Programmes:

In consonance with the ⁵ National IPR Policy of 2016, the ICAR guidelines have laid emphasis on the training of ICAR scientists about IPRs and on the need to increase IP awareness through post-graduate teaching in IPR. Therefore, ZTM and BPD Unit of IARI has regularly been conducting the IP training and awareness programmes. Judiciously structured annual training programs disseminate detailed knowledge of IP, starting from basics to commercialization. Each training programme conducted till now has received overwhelming response from the participants from all parts of the country. The duration of the programs was planned according to the topics to be covered. The training program details are provided below for reference:

A. IP Training Programs

From the year 2015 to 2019, ZTM & BPD Unit has effectively conducted two training programs per year. Significantly, these trainings gave appropriate insights, comprehensive information and hands-on sessions on various topics of Intellectual Property Rights to the participants to enable them to judiciously protect their IP and manage relevant aspects. These trainings witnessed, in total, around hundred participants from various parts of India and included researchers, students, industry personnel, scientists and academicians.

B. Awareness Programme

Several other initiatives have been undertaken by the ZTM and BPD Unit of IARI to promote IP management within the institute and for the ecosystem. Illustratively, IP Spectra and the IP Care program have been launched to create such awareness.

IP Spectra

IP Spectra- An Intellectual Property Facilitation Centre (IPFC) has been established at the ZTM and BPD Unit of IARI with financial support from Ministry of MSME, Government of India, for providing IP services to agro-based MSMEs. The mission of IPFC is to provide complete IP solutions and IP services like drafting and filing applications for Patents, Copyrights, Trademarks, Industrial Designs, and Plant Variety Protection. It also offers pre-grant and post-grant services, hand-holding support towards technology commercialization and advisory services to agri-start-ups and MSMEs. The IP Spectra's website (<http://ipspectra.ztmbpd.iari.res.in>) was launched to reach out to agri-start-ups and MSMEs as well as to create awareness about IP. The IPR training programmes are conducted by IP Spectra bi-annually and IPR awareness programs are conducted every three months.



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Table 1.1: List of IP Services Provided by IP Spectra

Service Code	IP Service
PA 01	First Introductory Meeting
PA 02	Patent> Prior Art Search Report (Patentability Assessment)
PA 03	Patent> Drafting of Patent application (Provisional Specification)
PA 04	Patent> Drafting of Patent application (Complete Specification/ Patent of Addition/ Divisional Patent)
PA 05	Patent> PCT filing support
PA 06	Patent> Drafting of Response to First Examination Report (FER)
PA 07	Patent> Support for infringement, opposition proceedings etc.
PA 08	Patent> Discussion with inventor at IP Cell
PA 09	Assistance in creating Patent Assignment Draft for Technology Transfer
PA 10	Drafting of Marketing Analysis Report
PA 11	Technology transfer discussions/ negotiations, finalization of Technology Transfer Agreement
TM 01	Trademark> Drafting Support
TM 02	Trademark> Drafting of Office Action Response
ID 01	Industrial Designs> Drafting support
PPV 01	PPV> Advise for data generation etc.
PPV 02	PPV> Drafting support
CP 01	Copyright> Drafting support
CP 02	Copyright> Drafting of Office Action Response
GA 01	Other Services> Customized report generation

IP CARE Consultancy

IP Care counsel under the IPFC has been established to provide free IP consultancy to the inventors and entrepreneurs on a non-chargeable basis. This initiative aids in clarifying and resolving IP related issues of inventors and researchers through direct outreach. The centre is located in ZTM & BPD Unit, IARI. Its IP advisories include:

- Technology evaluation
- Best Protection Mode
- IP Exchange
- General queries

⁵National IPR Policy; "Creative India; Innovative India: रचनात्मक भारत; अमिन्नव भारत;" 12th May, 2016; Government of India, Ministry of Commerce and Industry, Department of Industrial Policy and Promotion.





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CHAPTER 2

Intellectual Assets of ICAR-Indian Agricultural Research Institute

ICAR-IARI values and imparts due importance to intellectual properties (IPs) developed by its scientists, students and researchers. Therefore, Intellectual Property Management at ICAR-IARI follows a very structured process for management and protection of these IPs. This chapter focuses on the analysis of IP management carried out at ICAR and includes data from ZTM & BPD Unit, ICAR-IARI. These data have been sourced from the applications filed and granted for patents, PPVFRs, copyrights, trademark filings and commercialization. Graphical representation has also been used for easy interpretation of the results of IP management and technology commercialization.

Institutional Intellectual Property Management

1.A. Patent Application Filings and Grants

Patents are those licenses that confer a right or title for a set period, especially the sole right to exclude others from making, using, or selling an invention. The evolution of the patent regime at the national level prompted ICAR to come up with its IP Guidelines in 2006 and its adoption has led to a structured process, which is being followed at ICAR institutions. As a result of this increased awareness about IPR among scientists, active filing of patents with commercialization of the technologies has also increased to around 100 patent application since the year 2000. The unit has constantly worked towards protecting the IP generated by the Institute under ICAR in order to prevent third parties from using or marketing the same.

The detailed list of patent applications filed by IARI along with the status of grants for the technologies, where the applicant is ICAR (after 1972) from 1950 to 2020 is provided in Table 2.1.

Table 2.1: List of Patent Application Filings and Patent Grants from 1950-2020

S. No.	Application No.	Title of patent application	Date of Filing	Inventors	Grant No.	Status
1.	44194	An improved double bottom country plough.	November 11, 1950	-	44194	G
2.	47715	Improvements in or relating to preparation of terpenyl mono chloroacetates	July 21, 1952	-	47715	G
3.	48125	A process for the production of a mineral supplement for food for the cattle	September 24, 1952	-	48125	G
4.	48429	Improvements in or relating to preparation of terpenyl ethers and alcohols from turpentine oil.	November 13, 1952	-	48429	G
5.	49075	Improvements in or relating to manures from wool and hair wastes	March 02, 1953	-	49075	G

"Millions of people toil in the shadow of the law we make, and much of their livelihood is made possible by the existence of intellectual property rights."





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6.	49771	Improved groundnut planter	June 22, 1953	-	49771	G
7.	52580	Improvements in or relating to preparation of terpene thiocyanates for use as insecticides	August 20, 1954	-	52580	G
8.	57437	A process for the production of a mineral supplement for the cattle.	May 26, 1956	-	57437	G
9.	74630	Seed metering or distributing device for sowing machines, seed drills, planters, dibblers.	December 22, 1960	-	74630	G
10.	113193	Improvements in or relating to the production of terpene alcohols from turpentine oil and its components.	November 16, 1967	-	113193	G
11.	113909	A process for the preparation of enriched phosphatic fertilizer from low grade basic slag.	January 03, 1968	-	113909	G
12.	115716	Improvements in or relating to manufacture of terpenyl esters	May 03, 1968	-	115716	G
13.	121303	Improvements in or relating to agricultural pesticides more particularly those containing barium polysulphide and tobacco alkaloids	May 13, 1969	-	121303	G
14.	128129	Improvements in or relating to methylene dioxyphenyl derivatives.	August 21, 1970	-	128129	G
15.	133090	Improvements in or relating to preparation of 2, 2, 2-trichloro-1, 1-di-(4-chlorophenyl) ethanol.	October 01, 1971	-	133090	G
16.	1063/CAL /1974	An improved method for preparation of 1,1-di-(4-chlorophenyl)-2, 2,2,-trichloroethanol.	May 14, 1974	-	137624	G
17.	1442/CAL /1974	Improvements in or relating to preparation of alpha-substituted 3,4 methylenedioxybenzoyl derivatives as synergists for pyrethrins.	June 27, 1974	-	137926	G



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18.	465/DEL /2000	Pusa fruit coring device (Hand operated)	April 27, 2000	Dr. Hari Shanker Sharma, Dr. Amar Singh	-	G
19.	622/DEL /2000	A process for the preparation of neem oil emulsion concentrate EW (emulsion oil in water)	June 27, 2000	Dr. B. S. Parmar, Dr. Lalit Kumar	-	A
20.	0258/DEL /2001	Improved process for the preparation of Mancozeb	March 07, 2001	Dr. N. K. Roy, Dr. R. L. Gupta, Mr. A. K. Panda	226219	G
21.	453/DEL /2001	Improvement in or relating to the preparation of powdered Azadirachtin A- rich concentrate from neem seed kernel	April 04, 2001	Dr. Prem Dureja, Dr. R. S. Tanwar, Dr. S. K. Handa	-	A
22.	454/DEL /2001	A process for the preparation of mosquito larvicidal formulations based on Rabdosiamelissoide Ingredients	April 04, 2001	Dr. B. S. Parmar, Dr. Lalit Kumar	218311	G
23.	455/DEL /2001	Environmentally sound process for improvement in or relating to soil fertility & rice productivity	April 04, 2001	Mr. S. L. Gulati	-	A
24.	456/DEL /2001	Improvement in or relating to cultivation of Azotobacter by fermentation for sustainable agriculture	April 04, 2001	Mr. S. L. Gulati	-	A
25.	460/DEL /2001	Additives for improved photostability of Azadirachtin-A	April 04, 2001	Ms. Sapna Johnson, Dr. Prem Dureja, Mr. Swaran Dhingra	227536	G
26.	825/DEL /2001	A hyper-spectral data analyzing method for characterization and discrimination of natural/ man made resources from air borne platforms	August 02, 2001	Dr. (Mrs) Ravinder Kaur	214697	G
27.	1117/DEL /2001	Bioseed vessel	November 02, 2001	Mr. S. L. Gulati	-	A
28.	1119/DEL /2001	Bioinoculator	November 02, 2001	Mr. S. L. Gulati	-	A
29.	1120/DEL /2001	Improvement in process and device for production of quality Rhizobial inoculants at door step of farmers	November 02, 2001	Mr. S. L. Gulati	-	A





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30.	1121/DEL /2001	Diagnostic kit for testing of air contamination in fermentation Industry	November 02, 2001	Mr. S. L. Gulati	-	A
31.	1122/DEL /2001	Biofermentor	November 02, 2001	Mr. S. L. Gulati	-	A
32.	290/DEL /2002	A simple thin layer chromatographic process for obtaining azadirachtins A, B and H from crude azadirachtin concentrates	March 22, 2002	Dr. B. S. Parmar, Ms. Subhomay Sinha	-	A
33.	821/DEL /2002	A process of preparing a herbicidal composition against Phalaris minor from neem and the herbicidal composition prepared thereof	August 06, 2002	Mr. Shashibala Singh, Dr. Gita Kulshreshtha	-	A
34.	889/DEL /2002	Animal Feed Block Formation Machine	September 02, 2002	Er. Amar Singh, Dr. Sunil Kumar Jaha, Dr. Jaipal Singh Panwar,	-	PD
35.	444/DEL 2002	A process for the production of blue green algal biofertiliser	April 10, 2002	Dr. Bramha Dutta Kaushik	220746	G
36.	851/DEL /2002	Seed-Cum-Fertilizer Grain Drilling Machine	August 20, 2002	Dr. Bijan Kumar Dutt	231054	G
37.	846/DEL /2003	Pesticidaloxime esters	June 27, 2003	Dr. Suresh Walia, Dr. Balraj Singh Parmar	217763	G
38.	847/DEL /2003	Process for the preparation of mono/di/poliol ester pesticides	June 27, 2003	Dr. Paraj Shukla, Dr. Balraj Singh Parmar, Dr. Suresh Walia	218031	G
39.	866/DEL /2003	A process for preparing a Biofertilizer cum bio-fungicidal composition	July 02, 2003	Ms. Bineeta Sen, Shahana Majumdar, Krishanu Mukherje, Sanjeev Kumar, Kathithachalam Angappan, Goutam Mondal, Ms. Jyotsna Sharma, Mr. Chirantan Chattopadhyay	-	PD
40.	1126/DEL /2003	Improvement in/or relating to preparation of reduced azadirachtin (S) biopesticides	September 09, 2003	Mr. Suresh Walia, Ms. Vandana Sharma, Dr. Jitendra Kumar, Dr. Balraj Singh Parmar	226204	G



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41.	1983/DEL /2004	Powered Animal Feed Mixer	October 12, 2004	Mr. Amar Singh, Dr. Sunil Kumar Jha, Dr. Jaipal Singh Panwar, Dr. Adarsh Kumar	302775	G
42.	2150/DEL /2004	Light Heat and water resistant neem meliacin concentrates and product with controlled release	October 29, 2004	Dr. Balraj Singh Parmar, Dr. Chandershekhar Reddy, Dr. Suresh Walia, Dr. Jitendra Kumar	291334	G
43.	2416/DEL /2004	Improvements in/or relating to the preparation of liquid pesticidal concentrates of neem meliacin(s)	December 02, 2004	Dr. Balraj Singh Parmar, Dr. Prem Kumar, Dr. Suresh Walia, Dr. Jitendra Kumar	293925	G
44.	1988/DEL /2004	Urea Molasses Mineral Block Machine	October 12, 2004	Mr. Amar Singh, Mr. Brijesh Chandra Srivastava, Dr. Sunil Kumar Jha, Dr. Adarsh Kumar	283378	G
45.	1986/DEL /2004	Animal Feed Crusher	October 12, 2004	Er. Amar Singh, Dr. Sunil Kumar Jaha, Dr. Jaipal Singh Panwar, Dr. Adarsh Kumar	299908	G
46.	1592/DEL /2004	Improvement in/or relating to synthesis of O-alkyl derivatives of Oxime ethers of piperonal as potential fungicides	August 25, 2004	Mr. D. B. Saxena, Ms. Aarti Mahajan	281543	G
47.	69/DEL /2004	Improvement in/or relating to synthesis of 4-methyl 6 alkyl-2H pyran-2 ones as potential fungicides	January 16, 2004	Mr. Tarun Kumar Chattopadhyay, Dr. Prem Dureja	-	A
48.	70/DEL /2004	Improvement in/or relating to the preparation of thiophanate methyl	January 16, 2004	Mr. Tarun Kumar Chattopadhyay, Dr. Prem Dureja	-	W
49.	2417/DEL/ 2004	Pusa process for dried Onion Flakes	December 02, 2004	Mr. H. S. Sharma, Dr. Vidyaram Sagar, David Vijay Kumar Samuel	-	AS
50.	3459/DEL /2005	Composition for early, profuse sporulation under solid state of the improvised isolate of Trichoderma harzianum and a process thereof	December 23, 2005	Dr. Pratibha Sharma, Dr. Prem Dureja, Dr. Satish Kumar Sain, Dr. Dharam Vir Singh	296712	G



PATENTED

51.	3462/DEL /2005	Novel superabsorbent hydrogel/s and the method of obtaining the same	December 23, 2005	Dr. Rajesh Kumar, Dr. (Mrs.)Anupama, Dr. Balraj Singh Parmar	250349	G
52.	3461/DEL /2005	Process for the preparation of 5 substituted 1-3,4 oxiazole – 2 thiols as new urease and nitrification inhibitors	December 23, 2005	Dr. Rajesh Kumar, Dr. Anupama, Dr. Balraj Singh Parmar	279536	G PD
53.	1201/DEL /2005	A Process for isolation of parthenin from Parthenium hysterophorus as potential herbicide	May 11, 2005	Dr. D. B. Saxena, Mr. Ashok Kumar Gupta, Mr. Ravinder Kumar Kohli, Dr. N. A. Shakil	-	PD
54.	3458/DEL /2005	A process for the detoxification of chlorpyrifos residues in drinking water	December 23, 2005	Dr. Madhuban Gopal, Dr. Ram Niwas, Mr. Asif Helal, Mr. Hirani Mukherjee	-	PD
55.	405/DEL /2006	Bio pesticidal formulation with improved shelf life and the process of preparation.	February 14, 2006	Dr. Prem Dureja, Dr. Balraj Singh Parmar	234480	G
56.	1746/DEL /2006	Polymeric seed coats based on bioactive botanicals	July 31, 2006	Dr. Jitendra Kumar, Mr. Nisar Keyath, Dr. Suresh Walia, Dr. Balraj Singh Parmar, Dr. Arun Kumar Madurai Basappa	244542	G
57.	2218/DEL /2006	A novel bio-pesticidal formulation with improved shelf-life and the method for its preparation	October 10, 2006	Dr. Sudershan Ganguly, Dr. Anupama, Dr. Balraj Singh Parmar	284264	G
58.	481/DEL /2006	Improved neem Larvicidal Composition	February 22, 2006	Balraj Singh Parmar, Jitendra Kumar, Swaran Dhingra	282129	G
59.	482/DEL /2006	Mosquito Larvicidal Compositions	February 22, 2006	Dr. Balraj Singh Parmar, Mr. Ram Das Gopinath	282133	G
60.	687/DEL /2006	Pusa Process for experimental controlled atmosphere (CA) generation system	March 14, 2006	Dr. Ram Krishna Pal, Mr. David Vijay Kumar Samuel	-	PD
61.	1744/DEL /2006	Pusa process for production and storage of frozen ginger slices	July 31, 2006	Dr. Ram Krishna Pal, Dr. Lata, Mr. Wangdup Bhutia	-	PD
62.	1745/DEL /2006	A process for preparation of ready-to-use dehydrated carrot shreds	July 31, 2006	Mr. David Vijay Kumar Samuel, Dr. Vidyaram Sagar	-	PD



PATENTED

63.	2049/DEL /2006	Synthetic gene encoding Cry 1 Fa 1δ-endotoxin of Bacillus thuringiensis	September 18, 2006	Polumetla Ananda Kumar	242768	G
64.	2048/DEL /2006	Synthetic gene encoding a chimeric δ-endotoxin of Bacillus Thuringiensis	September 18, 2006	Polumetla Ananda Kumar	237912	G
65.	2217/DEL /2006	A process for the decontamination of vitavax residues from wheat seed	October 9, 2006	Dr. Madhuban Gopal, Dr. Ram Niwas, Mr. Ashok Gaur	-	PD
66.	0224/DEL /2007	An Insect Handling Device	February 05, 2007	Mr. Pradyumn Kumar, Mr. Javaji Chandra Sekhar	252363	PD
67.	1090/DEL /2007	Decision support System for on farm water Management- Farm Wat.	May 21, 2007	Dr. Madhuban Gopal, Dr. ram Niwas, Dr. Ashok Gaur	-	PD
68.	1809/DEL /2007	Improvement in Pesticidal Neem Preparations with Oxime Esters	August 27, 2007	Dr. B. S. Parmar, Mr. Ramdas Gopinath, Dr. Suresh Walia, Dr. Jitendra Kumar	-	PD
69.	2314/DEL /2007	Precision seeder for plug tray nursery	November 06, 2007	Dr. Sirohi Netrapal Singh, Er. Gaikwad Bhaskar Bharat	-	PD
70.	2315/DEL /2007	Development of entomopathogenic nematode-based termite bait and a technique to disseminate the bait for attracting and killing subterranean termites	November 06, 2007	Dr. Sharad Mohan, Dr. Jitendra Kumar, Dr. Anju Kamra, Dr. Harishankar Gaur	-	PD
71.	2316/DEL /2007	Solid state digesters for anaerobic fermentation of organic wastes for biogas and manure	November 06, 2007	Mr. Navendu Gupta, Mr. N. S. Kalra, Er. H. C. Joshi, Er. Sushil Kumar	-	PD
72.	694/DEL /2008	Bacillus Licheniformis MTCC 7445 for control of Soil borne pathogenic fungi	March 19, 2008	Dr. Prem Dureja, Mr. Praveen Kumar Sharma	-	PD
73.	693/DEL /2008	Synthetic gene encoding Cry 2 AA1 δ-endotoxin of Bacillus thuringiensis	March 19, 2008	Dr. Anand Kumar	-	PD
74.	1121/DEL /2008	Pusa Chickpea thresher	May 05, 2008	Mr. Sachchida Nand Sinha, Dr. Jagannath Prasad Sinha, Dr. Inderjit Singh Dhaliwal, Dr. Sewak Singh Ahuja	282047	G





PATENTED

75.	1618/DEL /2008	Methodology and composition of artificial diet for mass rearing of lepidopteran pests (in particular <i>helioverpa armigera</i> , <i>spodoptera litura</i> and <i>Earias vittella</i>)	July 07, 2008	Mr. Gorakhprasad Gupta, Ajanta Birah, Mr. Brijesh Singh, Mr. Gagana Kumar Mahapatro	-	PD
76.	2032/DEL /2008	Pusa 5SD- a bio-formulation of <i>Trichoderma harzianum</i> (IARI P-4) for seed treatment	August 28, 2008	Dr. Sunil Chandra Dubey	292555	G
77.	2033/DEL /2008	Pusa Bio-Pellet- a bioformulation of <i>Trichoderma harzianum</i> (IARI P-4) for soil application	August 28, 2008	Dr. Sunil Chandra Dubey	-	PD
78.	577/DEL /2009	Development of SCAR Marker for identification of <i>Chaetomium Globosum</i> - A potential biocontrol agent	March 25, 2009	Dr. Rashmi Aggarwal, Dr. Sangeeta Gupta, Dr. Renu	294901	G
79.	576/DEL /2009	Invention of Mohan's Infective Juvenile Isolator (MIJI) for isolating infective juveniles of entomopathogenic nematodes from infected insect cadavers	March 25, 2009	Dr. Sharad Mohan	-	W
80.	1710/DEL /2009	A novel formulation of Plant Growth promoting Rhizobacteria with enhanced shelf-life and the method of its preparation	August 18, 2009	Dr. Lata, Dr. Anupama, Dr. Balraj Singh Parmar	292524	G
81.	1292/DEL /2010	Novel Superabsorbent hydrogel/s and the method of obtaining the same	June 02, 2010	Dr. Anupama, Dr. Balraj Singh Parmar, Dr. Dhruva Jyoti Sarkar	274643	G
82.	2964/DEL /2010	Novel naphthyridine based hydrazines as potent agrochemicals	December 13, 2010	Dr. Rajesh Kumar, Dr. Nisha Aggarwal, Dr. Chitra Srivastava, Dr. Jitendra Mohan Khurana, Dr. Prem Dureja	349105	G
83.	518/DEL /2011	Liquid Bioinoculant of <i>Azotobacter chroococcum</i> and the process thereof	February 25, 2011	Dr. Sangeeta Paul, Dr. Biswajeet Paul, Mr. Maheshwar Singh Rathi, Dr. Brahma Kaushik	338098	G



PATENTED

84.	1599/DEL /2011	A Process for Preparation of Polymer Encapsulated Nano-Sulfur Fungicide	June 07, 2011	Dr. Manoranjan Ghose, Dr. Madhuban Gopal, Mr. Samrat Roy Choudhury, Ratan Dasgupta, Dr. Chakravarthi Devakumar, Dr. Subrahmanyam bhattachiprolu, Dr. Chitra Srivastava, Dr. Robin Gogoi, Dr. Rajesh Kumar, Dr. Arunava Goswami	277235	G
85.	PCT/IN2011 /000432	Novel Superabsorbent hydrogel/s and the method of obtaining the same	June 29, 2011	Dr. Anupama, Dr. Dhruva Jyoti Sarkar, Dr. Balraj Singh Parmar	-	NPE
86.	2053/DEL /2011	Pigeonpea Pod Stripper	July 21, 2011	Dr. J. P. Sinha	313550	G
87.	2051/DEL /2011	Nanoencapsulated Hexaconazole: A novel fungicide and the process for making the same	July 21, 2011	Dr. Madhuban Gopal, Dr. Samrat Roy Choudhury, Dr. Indrani Roy, Ms. Saheli Pradhan, Dr. Chitra Srivastava, Dr. Robin Gogoi, Dr. Rajesh Kumar, Dr. Arunava Goswami	292080	G
88.	2052/DEL /2011	Development of substituted alkene as a potential nematocide	July 21, 2011	Dr. Madhuban Gopal, Dr. Irani Mukherjee, Dr. Ram Niwas, Dr. Dwarika Prasad	-	PD
89.	2395/DEL /2011	Digital Soil Test Fertilizer Recommendation (STFR) Meter	August 24, 2011	Dr. S. C. Datta	330282	G
90.	257/DEL /2012	Development of slow release nano formulations of bioactive molecules and method of preparation thereof	January 31, 2012	Dr. N. A Shakil, Dr. Jitendra Kumar, Mr. M. K. Singh, Mr. Mulu Kumelachew Loha, Mr. Totan Adak, Mr. Prashant Kaushik, Mr. Arnab Roy Chowdhury, Mr. Dhruva Jyoti Sarkar, Pankaj	290155	G
91.	258/DEL /2012	A product and process for the decontamination of pesticide residues from vegetables by using safe reagent	January 31, 2012	Dr. Madhuban Gopal, Dr. Rajesh Kumar, Mr. Ram Niwas	290363	G





PATENTED

92.	419/DEL /2012	Production of cocktail polyclonal antibodies for broad spectrum ELISA based diagnosis of potyviruses and cucumoviruses using fusion construct derived from coat protein gene sequences from Papaya ringspot and Cucumber mosaic virus	February 15, 2012	Dr. Mandal Bikash, Dr. Jain K. R, Ms. Kapoor Reetika, Mr. Phaneendra C., Ms. Swapna Geetanjali	299749	G
93.	420/DEL /2012	Nanocopper-a copper based formulation to combat bacterial blight of pomegranate, rice and bean	February 15, 2012	Dr. Rakesh Kumar Jain, Dr. Mani Chander, Dr. N. S. Sipani, Dr. Kalyan K. Mondal	294416	G
94.	3130/DEL /2012	Heat Stable Anthocyanin Rich Composition and process of its preparation	October 08, 2012	Dr. Charanjeet Kaur, Dr. Suresh Walia, Mr. Ramkrishna Pal	321722	G
95.	3771/DEL /2012	A cross flow flexible membrane filtration assembly for small processing volume	December 07, 2012	Dr. G. P. Agarwal, Mr. M. R. Muthumareeswaran, Mr. Satyendra Singh	343546	G
96.	3744/DEL /2012	Amphiphilic polymers based slow release nano formulations of β -carotene and method of preparation thereof	December 06, 2012	Dr. Jitendra Kumar, Dr. N. A. Shakil, Mr. Braj Bhushan Singh, Dr. Suresh Walia	300102	G
97.	3745/DEL /2012	Anti-oxidant and anti-bacterial di-aryl-indazol-3-ols and their method of preparation thereof	December 06, 2012	Dr. N. A. Shakil, Dr. Jitendra Kumar, Mr. M. K. Singh	290085	G
98.	3746/DEL /2012	Development of polymeric formulations of bioactive molecules and method of preparation thereof	December 06, 2012	Dr. Jitendra Kumar, Dr. N. A. Shakil, Mr. Totan Adak, Dr. Dhruva Jyoti Sarkar, Dr. Arnab Roy Chowdhury	295150.	G
99.	3876/DEL /2012	A method for the control of Nematodes in plants	December 14, 2012	Dr. Umarao, Pradeep Papolu, Nagavara Prasad, Divya Kamraju, Prakash Banakar, Mukesh Kumar	-	AS
100.	909/DEL/ 2013	Carotenoid rich composition and process of its preparation	March 26, 2013	Dr. Charanjeet Kaur, Dr. Suresh Walia, Ms. Prerna Nath, Dr. Supradip Saha	-	AS



PATENTED

101.	1802/DEL /2013	Pusa Basmati Rice Thresher	June 19, 2013	Dr. J. P. Sinha, Dr. S. K. Jha, Anoop Kumar Dixit, Mr. Rohinesh Khurana, Mr. D. V. K. Samuel, G. S. Manesh, Mr. S. S. Atwal, Mr. A. K. Gupta, Mr. Ritish Sharma	-	G
102.	2093/DEL /2013	Zinc In Clay-Mineral Receptacles In Nanoforms For Their Use As A Advance Materials Including Novel Fertilizer	July 11, 2013	Dr. S. S. Mukhopadhyaya	-	G
103.	PCT/IB2013 /060946	A method for the control of Nematodes in plants	December 14, 2013	Dr. Umarao, Pradeep Papolu, Nagavara Prasad, Divya Kamraju, Prakash Banakar, Mr. Mukesh Kumar	-	PB
104.	959/DEL /2014	Nanofabrication process involving clay minerals as receptacles for manufacturing advanced nanomaterials including novel fertilizers	April 02, 2014	Dr. S. S. Mukhopadhyaya	-	AS
105.	989/DEL /2014	Nanofabrication of phosphorus on kaolin mineral receptacles	April 07, 2014	Dr. S. S. Mukhopadhyaya, Dr. Anu Kalia	316692	G
106.	1042/DEL /2014	Beneficiation of Phosphate Rock for the segregation of phosphorus containing heavy metal free minerals	April 16, 2014	Dr. Siddhartha Shankar Mukhopadhyay	301187	G
107.	2361/DEL /2014	Insecticidal Formulation of Novel Strain of Bacillus thuringensis AK 47	August 20, 2014	Dr. A. K. Saxena, Mr. Jasdeep Chatrath Padaria, Mr. G. T. Gujar, Mr. A. N. Yadav, Mr. S. A. Lone, Ms. Monika Tripathi, Mr. M. V. S. Rajawat	340541	G
108.	2362/DEL /2014	Rapid Detection of Large Cardamom Chrike Virus	August 20, 2014	Dr. Bikash Mandal, Dr. Rakesh Kumar Jain, Dr. Yogita Maheshwari, Dr. Selvaraj Vijayanandraj	-	AS
109.	3981/DEL /2014	Process for Obtaining High Purity Phycocyanin from Cyanobacteria	December 29, 2014	Dr. Sunil Pabbi, Dr. Hilol Chakdar, Dr. Roshan Kumar,	-	AS





PATENTED

110.	PCT/IB2015/000433	Nanofabrication process involving clay minerals as receptacles for manufacturing advanced nanomaterials including novel fertilizers	April 01, 2015	Dr. S. S. Mukhopadhyaya	-	PB
111.	PCT/IB2015/000439	Nanofabrication of phosphorus on kaolin mineral receptacles	April 02, 2015	Dr. S. S. Mukhopadhyaya	-	PB
112.	PCT/IB2015/000437	Beneficiation of Phosphate Rock for the segregation of phosphorus containing heavy metal free minerals	April 02, 2015	Dr. S. S. Mukhopadhyaya	-	PB
113.	1608/DEL/2015	Device for Recommending A Crop Yield Enhancer	June 03, 2015	Dr. S. C. Datta, Dr. S. P. Datta	-	AS
114.	2432/DEL/2015	Plant transformation vector for suppressing MIPS gene expression and method for culturing low phytate soybean	August 07, 2015	Dr. Archana Sachdev, Mr. Awadhesh Kumar, Mr. Alkesh Hada, Mrs. Veda Krishnan, Mrs. Monica Jolly, Mrs. Mansi Punjabi, Mrs. Nabneeta Basak, Mrs. Vanita Pandey, Mr. Ashish Marathe	341699	G
115.	3364/DEL/2015	A Microbial Consortium of Nitrogen, Phosphorus and Potassium (NPK) Providing Bacteria	October 19, 2015	Dr. A. K. Saxena, Dr. Mahendra Singh Rajawat	-	AS
116.	PCT/IB2016/053174	Digital Soil Test and Fertilizer Recommendation (STFR) Meter	May 30, 2016	Dr. S. C. Datta, Dr. S. P. Datta, Dr. M. C. Meena, Ms. Mandira Barman, Mr. Kapil Atmaram Chobhe, Mr. Brahma Swaroop,	-	PB
117.	201711000736	An Apparatus for in vivo Mass Production of Entomopathogenic Nematode	January 07, 2017	Dr. Sharad Mohan	-	AS
118.	201711009555	A semi-synthetic diet for mass rearing five species of genus Bactrocera (Insecta: Diptera: Tephritidae) of agricultural and quarantine significance	March 20, 2017	Dr. Vinay Kumari Kalia, Dr. Babita Yadav, Dr. Tanu Sethi	-	UE



PATENTED

119.	201711016288	Method and Apparatus for Side View Imaging for Field Phenotyping of Crop Biomass and Growth	May 09, 2017	Dr. Rakesh Pandey, Dr. Mahesh Meena, Dr. Vijay Paul, Mr. Tirtha Das Gupta, Mr. Ramesh Chandra Meena	-	UE
120.	201911014982	Natural Carrier Based Anthocyanin Formulation For Targeted Release In Git And Process Thereof	April 15, 2019	Dr. Supradip Saha, Dr. Anirban Datta, Dr. Niladrishekhar Chatterjee, Dr. C. S. Tejpal	-	NP
121.	201911051754	The 3' polymorphic primers for species-specific detection of begomovirus	December 13, 2019	Dr. Bikash Mandal, Dr. Anirban Roy, Mr. Pradeep Kumar, Mr. Vikas Solanki, Mr. Satyam Patel	-	NP
122.	202011024290	A microcontroller based real time data acquisition system integrated solar dryer	June 10, 2020	Dr. Indra Mani, Dr. H.L. Kushwaha, Ms. Silpa Mandal	-	NP
123.	202011026699	Powered Integral Equipment	June 24, 2020	Dr. Indra Mani, Dr. P. K. Sahoo, Dr. Satish Devram Lande and Dr. Roaf Ahmad Parray	-	NP
124.	202011028155	UAN cum Seed Applicator	July 02, 2020	Dr. Indra Mani, Dr. Tapan Kumar Khura, Dr. Satish Devram Lande, Dr. Roaf Ahmad Parray and Dr. Prem Kumar Sundaram	-	NP
125.	202011030310	Off-Grid Batteryless Solar Refrigerated Evaporatively Cooled Mesh Fabric Structure For Storage Of Perishable	July 16, 2020	Dr. Sangeeta Chopra, Dr. Randolph Beaudry, Dr. Norbert Mueller. Dr. Indra Mani.	-	NP
126.	202011035828	Efficient Methodology for Natural Vitamin E Extraction from Edible Vegetable Oils	August 20, 2020	Shelly Praveen, Vinutha T.	-	NP
127.	202011037363	Hydro, Hydro-Thermal and Thermal Near Infrared Rays Treatments To Reduce Rancidity In Pearl Millet Flour	August 31, 2020	Shelly Praveen, Vinutha T., R. R. Kumar, Suneha Goswami	-	NP

* G: Granted Patent; PB: Published; PD: In Public Domain; A: Abandoned, W: Withdrawn, AS: Amended Stage, UE: Under Examination; NP: Not Published; NPE: National Phase Entry



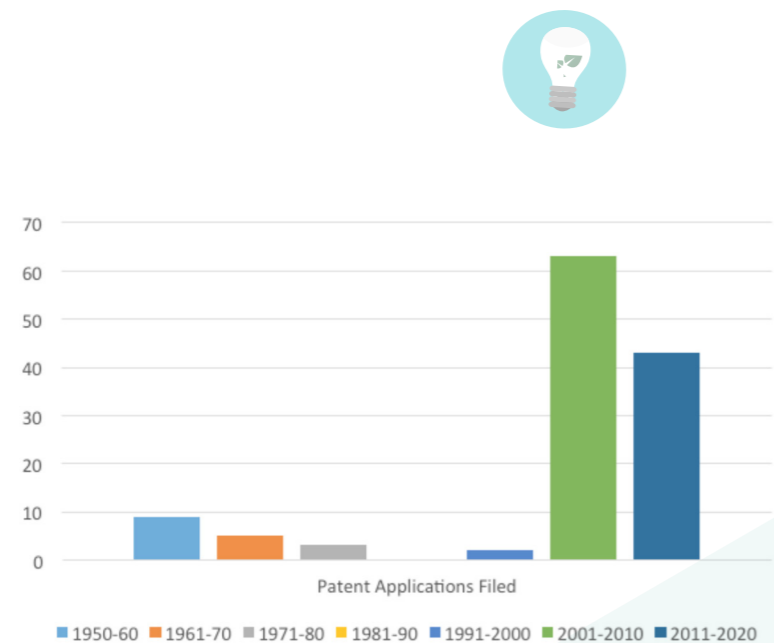


Figure 2.1: Patent filing trend from 1950-2020

As depicted in figure 2.1, there has been a sluggish growth with only twenty patent applications filed during the period from 1950 to 2000. The reason for this low number of patents filed during this period is attributed to the fact that the outcome of all scientific research and technology development was freely available for the public good, irrespective of their commercialisation by the public or private sectors, hence there was less awareness and sensitization concerning the importance of intellectual property in academic settings. After the year 2000, the trend of patent applications surged up owing to IP awareness workshops at academic institutions level. Academic institutes became more sensitized towards the importance and utility of IP and constituted their institutional IP policies. Moreover, as a direct consequence of the Ayyangar Committee report of September, 1959, the patent regime saw the introduction of the 'Patents Act, 1970. Under the original statute, agrochemical products and pharmaceutical products were not eligible for patents. However, with the Patents (Amendment) Act, 1999 that was brought into force retrospectively from 1st January, 1995. The amended Act provided for filing of applications for product patents in drugs, pharmaceuticals and agrochemicals. It was only when this statute was amended and the bar on patent eligibility of certain inventions was removed, did the patent filing in the agrochemical domain get boosted.

The Zonal Technology Management Centre (ZTMC) and Institute Technology Management Unit (ITMU) played active roles in advising scientists on patent filing procedures such as drafting, preparing FER responses, attending hearings, and post-grant maintenance. As shown in the figure, a fluctuating trend of patent filings is evident, nevertheless, an upsurge can be noticed after the year 2000, wherein 11 patents were filed in the single year 2001-02 and the same trend was also found in 2011-12. From 2005 to 2020, more than 25 patent applications have been filed in the agro-chemicals segment.

The proactive approach of the ZTM & BPD Unit proved to be potentially successful, as number of patents granted increased over time. The increase in the number of grants during 2011-2020 is around 2.5 times higher than that observed from 2001-2010. Meanwhile, the patent office of the Government of India has also expedited the process of examination and prosecution of the patent applications with the help of 456 new examiners of patents in various fields of technology.

6. The Patents Act 1970, along with the Patents Rules 1972, came into force on 20th April 1972, replacing the Indian Patents and Designs Act 1911. The Patents Act was largely based on the recommendations of the Ayyangar Committee Report headed by Justice N. Rajagopala Ayyangar. One of the recommendations was the allowance of only process patents with regard to inventions relating to drugs, medicines, food and chemicals.



This further enabled the Indian Patent Office for reduction in pendency and backlog in the examination from the present 5 to 7 years to just 18 months by March, 2018.

The specification of internal procedures during 2005-2010 is a direct result of implementing the IP management policy of the ICAR. The internal procedures of the ZTM & BPD Unit, ICAR-IARI were further streamlined from 2011 to 2013 under expert guidance. These new systems and procedures enabled granting of maximum numbers of patents in 2017-18.

The ZTM & BPD Unit has played a pivotal role in sensitizing the scientific community about the benefits of filing patents and IP management by conducting number of workshops and more than 50 awareness programs. These workshops and awareness programs were well attended and received by the participants who came from across the India. This has helped in eliciting the interest of more scientists to generate new IPRs on the basis of their research that with potential of commercialization. As a result, the research conducted during this time resulted in a greater number of patent filings.

To accelerate and ease the process of patent filing from the ICAR institutes, various efforts have been made to promote the IP filing process with the establishment of ZTM & BPD Unit, IARI. The Institute Technology Management Committee (ITMC) was constituted for screening and filing of patents. Special steps have been taken to strengthen ZTM & BPD Unit with respect to the resources required for procuring patent databases, market databases, and skilled manpower. Great emphasis has also been laid on the skill development and training of the IP staff.

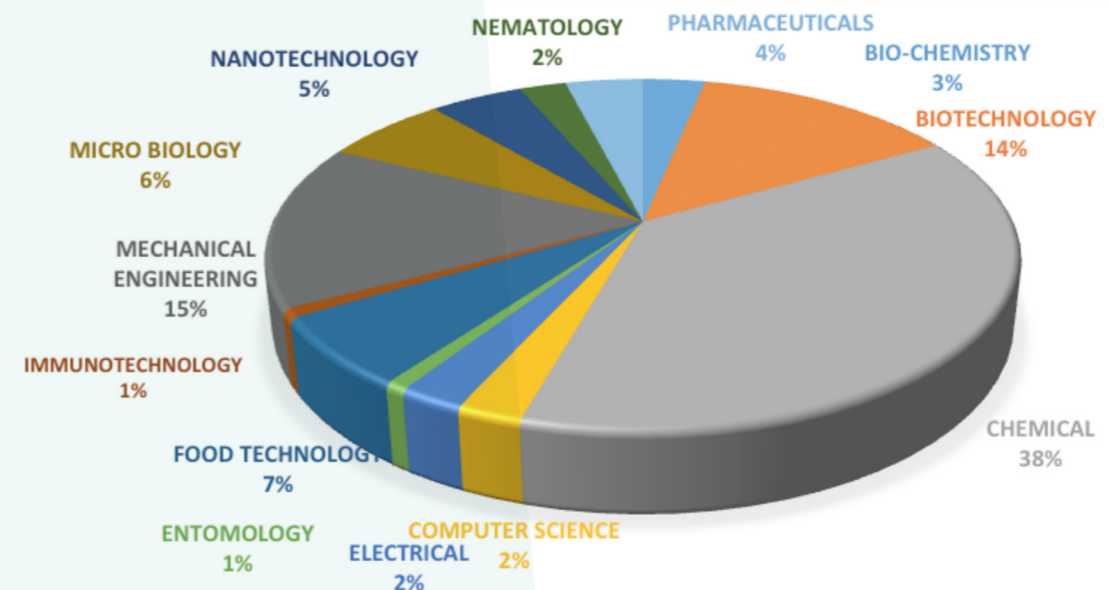


Figure 2.2: Domain-wise percentage of patent application filings from 1950-2020

The percentage-wise distribution of patent applications shows a picture of 38% share of patent applications falling under the category of chemicals (Fig 2.2). Chemicals, in this context, mean agrochemicals, i.e. formulations used for seed treatments and pest management, mosquito larvicidal compositions, etc. After chemicals, the major share of the applications come from the field of mechanical engineering (15%), which includes agricultural implements and machines related to threshing, animal feed block formations etc. The third category is biotechnology (14%), which stands for the inventions related to biotechnological applications.

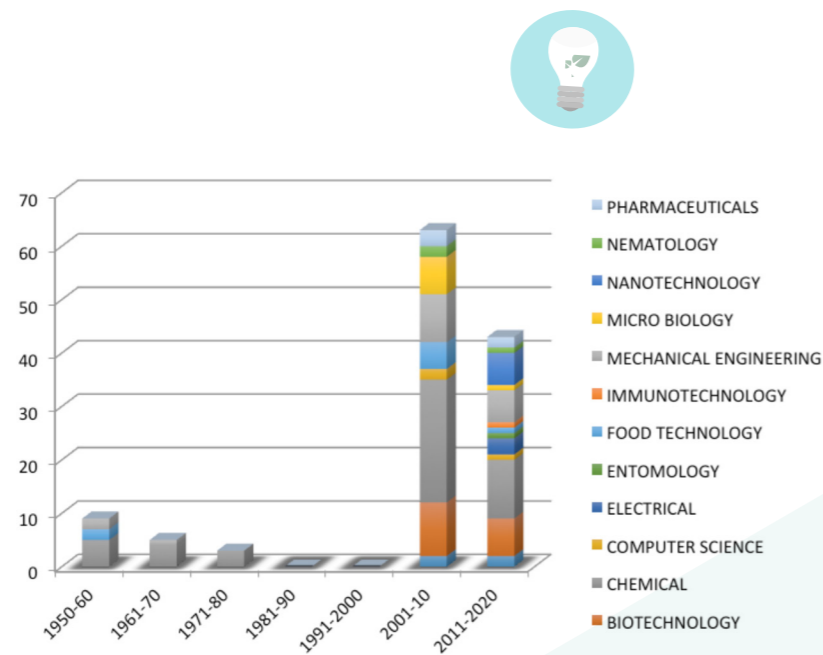


Figure 2.3: Domain of filed patent applications vs. Decades of filings

As per figure 2.3, decade wise Analysis of patents filed from 1950 till 2020 portrays that number of patents in chemical stream exceeds those in other fields over the decades. After chemicals, its biotechnology followed by mechanical engineering.

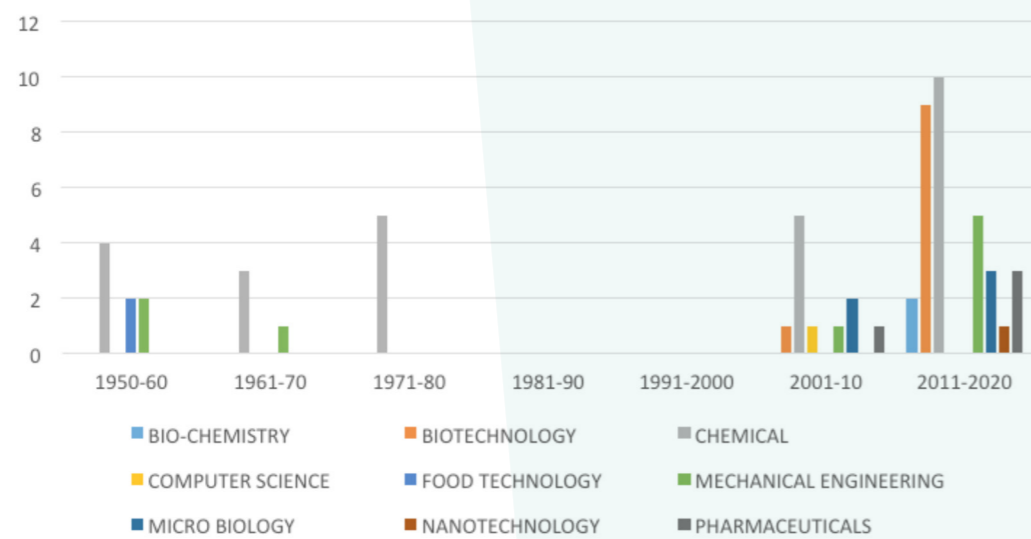


Figure 2.4: Decade-wise distribution of granted patents

The decade-wise demonstration of granted patents shows a steep rise from the year 2000 onwards (Fig 2.4). Analysis of patents filed from 1950 till 2020 portrays that patents granted under chemicals rank over other fields by a fair volume in all the decades. After chemicals, biotechnology leads among the other fields followed by mechanical engineering. The constant innovation in the sector has given rise to many innovations and hence patents.



1.B. Patent Commercialization

The impetus to licensing and commercialization of the technologies has gained momentum due to the new patent regime in 2005. Formulation of well-defined ICAR guidelines and government policies on IP, along with the growing awareness among the scientific community has supplemented this growth. The licensing and commercialization of the technologies developed by the ICAR-Indian Agricultural Research Institute were commercialized to the potential licensees after related patent applications were filed at Indian Patent Office. As per the technology commercialization policy of ICAR, all the technologies/ know-how has to be transferred on non-exclusive terms. This helps in wider dissemination and adoption of technologies by target industries and organizations.

ZTM & BPD Unit is one-stop window to connect public sector agri-technologies to the corporate world and Medium & Small Enterprises (MSMEs) in a business mode, it had licensed more than 250 technologies to various licensees till 2020. Among the licensed technologies, the technologies, for which patent application has been filed is provided in the table 2.2 with all the licensing details.

Table 2.2: Commercialization of IARI Technologies and the Status of Patents Applied and Granted

S. No.	Patent Application No.	Title	Grant No.	No. of Licensees (s)	Licensee(s)
1.	444/DEL/2002	A process for the production of blue green algal biofertiliser	220746	5	M/s. Sai Bio Organics, M/s. Eco Inputs, M/s. Ecological Products, M/s. Ecofert Ag and M/s. Forex Fastner (P) Ltd.
2.	889/DEL/2002	Animal Feed Block Formation Machine	-	2	M/s. Standard Hydraulics and M/s. Perfect Hydro Machines
3.	909/DEL/2013	Carotenoid rich composition and process of its preparation	-	1	M/s. Vaishnavi Biotech Ltd.
4.	3459/DEL/2005	Composition for early, profuse sporulation under solid state of the improvised isolate of Trichoderma harzianum and a process thereof	296712	2	M/s. Sai Bio Organics and Office of the Joint Director Agri. (Plant Pathology), State Bio-Fertilizer Quality Control Laboratory (SBFQCL)
5.	3462/DEL/2005	Novel superabsorbent hydrogel/s and the method of obtaining the same	250349	1	M/s. Vishwagel, Division of Earth International Pvt. Ltd.
6.	2218/DEL/2006	A novel bio-pesticidal formulation with improved shelf-life and the method for its preparation	284264	2	M/s Multiplex Bio-tech Pvt. Ltd. and M/s Rallis India Ltd.
7.	2049/DEL/2006	Synthetic gene encoding Cry 1 Fa 1δ-endotoxin of Bacillus thuringiensis	242768	2	M/s. Krishidhan Research foundation and M/s. Ankur Seeds Pvt. Ltd.



PATENTED

8.	518/DEL/2011	Liquid Bioinoculant of <i>Azotobacter chroococcum</i> and the process thereof	338098	1	M/s. Eco Inputs
9.	2395/DEL/2011	Digital Soil Test Fertilizer Recommendation (STFR) Meter	330282	14	M/s Systronics (India) Ltd., M/s. Plastic Surge Pvt. Ltd. and M/s. W. S. Telematics Pvt. Ltd
10.	3130/DEL/2012	Heat Stable Anthocyanin Rich Composition and process of its preparation	321722	2	M/s. Vaishnavi Biotech Ltd. and M/s South Asia Biotechnology Center (SABC)
11.	1608/DEL/2015	Device for Recommending A Crop Yield Enhancer	-	3	M/s. Octopus Inc., M/s SUGWAY Agribiotech & Research Foundation and M/s. Om Agro Organics
12.	3364/DEL/2015	A Microbial Consortium of Nitrogen, Phosphorus and Potassium (NPK) Providing Bacteria	355313	3	M/s. Monal Potteries & Ceramics Pvt. Ltd., M/s T-Stanes & Company Ltd and M/s. Prathistha Industries Ltd

II. The Protection of Plant Varieties and Farmers' Rights

The Govt. of India enacted "The Protection of Plant Varieties and Farmers' Rights (PPV&FR) Act, 2001" adopting *Sui Generis* system with sufficient provisions to protect the interests of public sector breeding institutions and farmers. The legislation recognizes the contributions of both commercial plant breeders and farmers in plant breeding activity and also aids in implementation of TRIPs in a way that supports the specific socio-economic interests of all the stakeholders including private, public sectors and research institutions, as well as resource-constrained farmers.

All extant plant varieties from ICAR that were notified under Section 5 of the Seeds Act, 1966 which have not completed 15 years from their notification date can be registered and protected as IP under PPV & FR Act. As per the Section 1.5.2 of Chapter 1 of '**ICAR Guidelines for Intellectual Property Management and Technology Transfer/ Commercialization**', 'Ownership of IP generated in ICAR or caused to be generated by ICAR shall vest with the ICAR'.

7. The Protection of Plant Varieties and Farmers' Rights (PPV&FR) Act, 2001; The Protection of Plant Varieties and Farmers' Rights Authority, Department of Agriculture, Co-operation and Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Govt. of India.



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ICAR follows a streamlined process for the registration of new varieties under the PPV&FRA Act, 2001 and amendment in 2007. In order to protect the extant and new plant varieties developed by IARI under ICAR, 61 PPV&FR applications have been filed at the PPV&FR Authority from 2011 to 2019 (Table No. 2.3) with ICAR as the applicant to enable these varieties' easy access to market for the benefit of agriculture sector. In the time span of 2012 to 2019, 37 extant and new crop/ vegetable varieties were registered by IARI at the PPV&FR Authority.

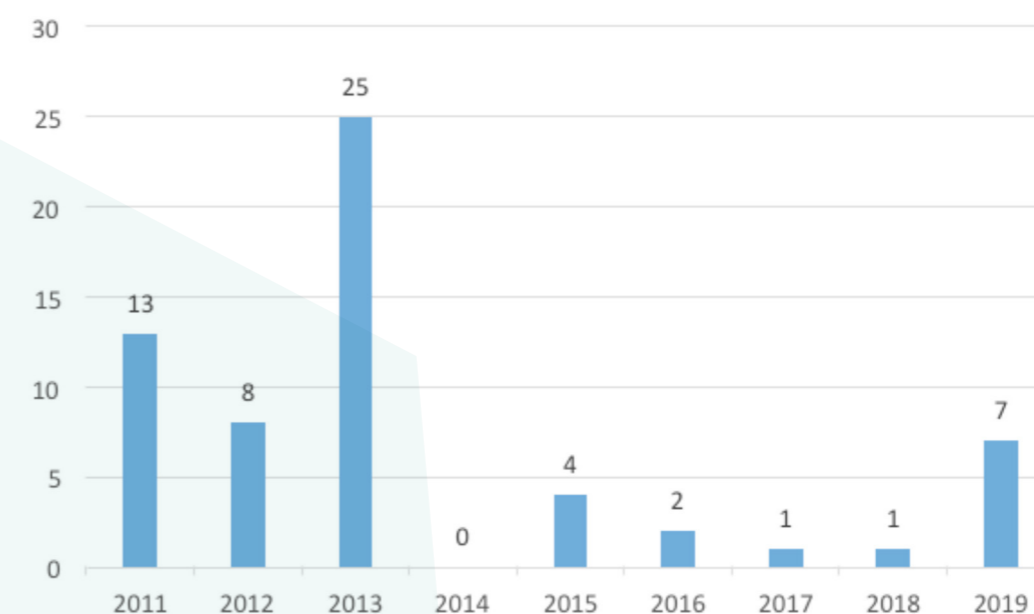


Figure 2.5: Plant variety applications filed during 2011-2019

Table 2.3: Plant Variety Application Filings and Registration Details from 2011 -2019

S. No.	Acknowledgement No.	Denomination	Crop Type	Date Filing	Variety Category	Inventor	Reg: No.
1.	REG/2011/255	Hd 2985 (Pusa Basant)	Wheat	January 06, 2011	New	Dr. G. P. Singh	655 of 2014
2.	REG/2011/256	Hd 2987(Pusa Bahar)	Wheat	January 06, 2011	New	Dr. G. P. Singh	643 of 2014
3.	REG/2011/257	Hd 2967	Wheat	January 06, 2011	New	Dr. R. K. Sharma	647 of 2014
4.	REG/2011/259	Pusa Meghna (Dc/98-2)	Cauliflower	January 06, 2011	Extant	Dr. Pritam Kalia	83 of 2013
5.	REG/2011/260	Pusa Ankur (Dbsr-91)	Brinjal	January 06, 2011	Extant	Dr. Ravinder Kumar	82 of 2013



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6.	REG/2011/258	Pusa Ageti	Cabbage	January 06, 2011	Extant	Dr. Pritam Kalia	309 of 2019
7.	REG/2011/309	Pusa Sharad (sel-309-1-2)	Cauliflower	June 13, 2011	Extant	Dr. Pritam Kalia	158 of 2012
8.	REG/2011/310	Pusa Bindu	Brinjal	June 13, 2011	Extant	Dr. Pritam Kalia	-
9.	REG/2011/425	Pusa Prachi (Hi 1563)	Wheat	July 25, 2011	New	Dr. A. N. Mishra	236 of 2016
10.	REG/2011/429	Pusa Sadabahar	Tomato	July 27, 2011	Extant	Dr. Pritam Kalia	283 of 2019
11.	REG/2011/431	Pusa Anmol	Chrysanthemum	July 27, 2011	Extant	Dr. K. V. Prasad	434 of 2016
12.	REG/2011/430	Pusa Centenary	Chrysanthemum	July 27, 2011	Extant	Dr. K. V. Prasad	-
13.	REG/2011/428	Pusa Rohini	Tomato	July 27, 2011	Extant	Dr. Pritam Kalia	241 of 2018
14.	REG/2012/92	Pusa Hybrid-8	Tomato	March 04, 2012	Extant	Dr. Pritam Kalia	-
15.	REGg/2012/91	Pusa Uttam	Brinjal	March 04, 2012	Extant	Dr. Pritam Kalia	-
16.	REG/2012/90	Pusa Upkar	Brinjal	March 04, 2012	Extant	Dr. Pritam Kalia	-
17.	REG/2012/389	HDCSW 16	Wheat	March 09, 2012	New	Dr. Rajbir Yadav	-
18.	REG/2012/390	HDCSW 18	Wheat	March 09, 2012	New	Dr. Rajbir Yadav	-
19.	REG/2012/154	Pusa Basmati 1509 (let 21959)	Rice	September 05, 2012	New	Dr. A. K. Singh	158 of 2019
20.	REG/2012/414	Pusa Green 112	Chickpea	September 24, 2012	New	Dr. J. Kumar	-
21.	REG/2012/415	Pusa 2085	Chickpea	September 24, 2012	New	Dr. J. Kumar	-
22.	REG/2013/419	Pusa Riddhi	Onion	January 08, 2013	New	Dr. Pritam Kalia	-
23.	REG/2013/536	Vsl-5	Indian Mustard (Sarso)	April 10, 2013	Extant	Dr. D. K. Yadava	550 of 2014



PATENTED

24.	REG/2013/522	Agrani (Sej-2)	Indian Mustard (Sarso)	April 10, 2013	Extant	Dr. D. K. Yadava	148 of 2014
25.	REG/2013/523	Pusa Mustard -21 (Les-1-27)	Indian Mustard (Sarso)	April 10, 2013	Extant	Dr. D.K. Yadava	146 of 2014
26.	REG/2013/524	Pusa Mustard-26 (Npj-113)	Indian Mustard (Sarso)	April 10, 2013	Extant	Dr. D. K. Yadava	153 of 2014
27.	REG/2013/525	Pusa Mustard-27 (Ej-17)	Indian Mustard (Sarso)	April 10, 2013	Extant	Dr. D.K. Yadava	152 of 2014
28.	REG/2013/526	Pusa Mustard 28 (Npj-124)	Indian Mustard (Sarso)	April 10, 2013	Extant	Dr. D. K. Yadava	327 of 2014
29.	REG/2013/527	Pusa Mustard 22 (Let-17)	Indian Mustard (Sarso)	April 10, 2013	Extant	Dr. D.K. Yadava	328 of 2014
30.	REG/2013/528	Pusa Karishma (Les-39)	Indian Mustard (Sarso)	April 10, 2013	Extant	Dr. D. K. Yadava	332 of 2014
31.	REG/2013/529	Pusa Mahak (Jd-6)	Indian Mustard (Sarso)	April 10, 2013	Extant	Dr. D. K. Yadava	329 of 2014
32.	REG/2013/530	Pusa Mustard 30 (Les-43)	Indian Mustard (Sarso)	April 10, 2013	Extant	Dr. D. K. Yadava	797 of 2014
33.	REG/2013/531	Pusa Mustard 29 (Let-36)	Indian Mustard (Sarso)	April 10, 2013	Extant	Dr. D. K. Yadava	760 of 2014
34.	REG/2013/532	Pusa Vijay (Npj-93)	Indian Mustard (Sarso)	April 10, 2013	Extant	Dr. D. K. Yadava	326 of 2014
35.	REG/2013/533	Pusa Ej-9912-13	Indian Mustard (Sarso)	April 10, 2013	Extant	Dr. D. K. Yadava	330 of 2014
36.	REG/2013/534	Pusa Mustard-24 (Let-18)	Indian Mustard (Sarso)	April 10, 2013	Extant	Dr. D. K. Yadava	334 of 2014
37.	REG/2013/535	Pusa Mustard -25 (Npj-112)	Indian Mustard (Sarso)	April 10, 2013	Extant	Dr. D. K. Yadava	333 of 2014
38.	REG/2013/537	Pusa Aditya (Npc-9)	Indian Mustard (Karan Rai)	April 10, 2013	Extant	Dr. D. K. Yadava	331 of 2014



PATENTED

39	REG/2013/538	Pusa Swarnim (Igc-01)	Indian Mustard (Karan Rai)	April 10, 2013	Extant	Dr. D. K. Yadava	335 of 2014
40	REG/2013/291	Pusa Shyamla	Brinjal	April 30, 2013	Extant	Dr. Pritam Kalia	-
41	REG/2013/292	Pusa Kartik Sankar	Cauliflower	April 30, 2013	Extant	Dr. Pritam Kalia	-
42	-	Pusa Basmati 1121	Rice	May 02, 2013	Extant	-	81 of 2013
43	REG/2013/303	DbI - 02	Brinjal	May 17, 2013	New	Dr. Pritam Kalia	-
44	REG/2013/304	Pusa Hybrid-20 (Dbhl-20)	Brinjal	May 17, 2013	New	Dr. Pritam Kalia	274 of 2016
45	REG/2013/1281	Pusa 1592-06-5-2, Iet No. 22289	Rice	December 12, 2013	EDV	Dr. A. K. Singh	-
46	REG/2013/1282	Pusa 1612-07-6-5	Rice	December 12, 2013	EDV	Dr. A. K. Singh	-
47	REG/2015/325	HD 3043	Wheat	February 19, 2015	New	Dr. G. P. Singh	246 of 2017
48	REG/2015/326	PUSA Gautami (HD 3086)	Wheat	February 19, 2015	New	Dr. G. P. Singh	376 of 2016
49	REG/2015/1286	PUSA Pachheti (HD 3059)	Wheat	June 07, 2015	New	Dr. J. B. Sharma	422 of 2016
50	REG/2015/1287	HD 3090 (PUSA Amulya)	Wheat	June 07, 2015	New	Dr. J. B. Sharma	423 of 2016
51	REG/2016/668	PUSA Snowball K-25	Cauliflower	February 06, 2016	Extant	Dr. Chander Parkash	-
52	REG/2016/952	PUSA Vatsala (HD 3118)	Wheat	July 22, 2016	Extant	Dr. P. K. Singh	121 of 2017
53	REG/2017/1869	PUSA DOUBLE ZERO MUSTARD 31 (PDZ-1)	Indian mustard (Sarso)	September 18, 2017	New	Dr. D. K. Yadava	-
54	REG/2018/692	HD 4728 (PUSA MALWI)	Wheat	September 14, 2018	Extant	Dr. Vinod	119 of 2019



PATENTED

55	REG/2019/138	PUSA SUGANDH 5	Rice	November 04, 2019	Extant	Dr. Gopal Krishnan	-
56	REG/2019/137	PUSA BASMATI 6(IET NO. 18005)	Rice	November 04, 2019	Extant	Dr. Gopal Krishnan	-
57	REG/2019/139	PUSA BASMATI 1718	Rice	November 04, 2019	Extant	Dr. Gopal Krishnan	-
58	REG/2019/140	PUSA BASMATI 1728	Rice	November 04, 2019	Extant	Dr. Gopal Krishnan	-
59	REG/2019/141	PUSA BASMATI 1637	Rice	November 04, 2019	Extant	Dr. Gopal Krishnan	-
60	REG/2019/142	PUSA BASMATI 1609	Rice	November 04, 2019	Extant	Dr. Gopal Krishnan	-
61	REG/2019/143	PUSA SAMBA 1850	Rice	November 04, 2019	Extant	Dr. Gopal Krishnan	-

The registration process was initiated in 2012-13 after an initial filing in the year 2011 as per figure 2.6. It has been noticed that highest number of PPVFRA registrations were granted in the year 2014-15 with a total of 20 registrations. Again in 2016-17, total six varieties were granted registration by the PPVFRA .

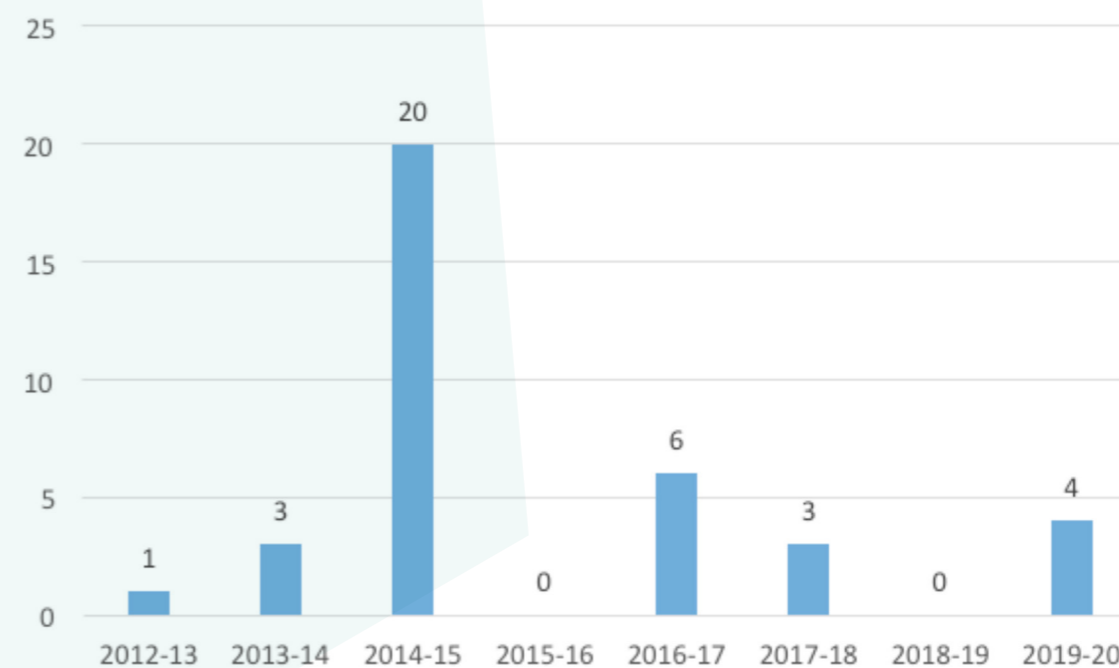


Figure 2.6: Registration of PPVFRs during 2012-2020





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The analysis of cropwise registrations of plant varieties with the PPVFRA (Fig 2.7) demonstrates that mustard varieties have received the maximum number of registrations. Significantly, wheat as an important crop, has contributed 28 percent share of registrations. Among the vegetable crops, tomato, brinjal and cauliflower have obtained 19 percent registrations under PPVFRA.

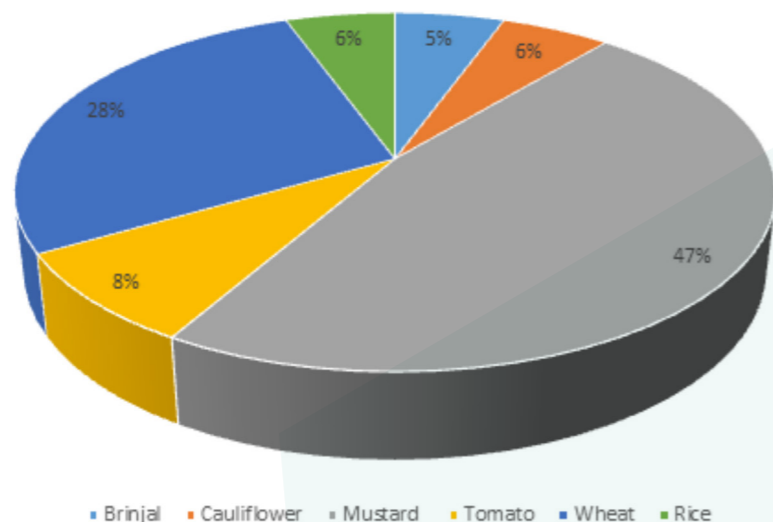


Figure 2.7: Cropwise share of major crops granted PPV&FR Registration

As mentioned earlier, the total plant variety filings till 2019 were 61 and out of these filings, fifteen (15) varieties have thus far been licensed to different stakeholders for commercialization (Fig 2.8).

Amongst these, wheat variety Pusa Gautami (HD 3086) has been one of the most popular varieties and has been licensed to as many as 218 licensees, thereby generating a revenue of Rs. 1,27,50,065 (Rupees One Crore Twenty Seven Lakhs Fifty Thousand and Sixty Five) till December 2020. Its salient features include an average yield of 5.4 t/ha in timely sown irrigated fields, maturity in 145 days with resistance towards Yellow and Brown rust. The recommended zones for this variety include Punjab, Haryana, Delhi, Rajasthan (except Udaipur and Kota Division) Western Uttar Pradesh area (except Jhansi Division), Jammu and Kathua Districts of Jammu & Kashmir, Ponta Valley and Una districts of Himachal Pradesh and Tarai region of Uttarakhand.

Similarly, the HD 2967 has also been licensed to 37 licensees, thereby generating a revenue of Rs. 18,50,000 (Rs. Eighteen lakhs and Fifty thousand). Wheat variety HD 2967 possesses very high adult plant resistance against most prevalent leaf rust diseases along with 78S84 and 46S119, two most virulent races of yellow rust disease. It also has better degree of resistance against leaf blight. The HD 2967 matures in 129 (NEPZ) and 143 days (NWPZ). Its average yield in NWPZ is 5.0 t/ha and 4.4 t/ha in NEPZ. It is a widely accepted and popular variety and carries diversified genes other than 1B/1R. The recommended areas for this variety includes Punjab, Haryana, Delhi, Rajasthan (except Udaipur & Kota Divisions) Uttar Pradesh, Jammu & Kathua Districts of J&K, Ponta Valley and Una districts of Himachal Pradesh and Tarai region of Uttarakhand, Bihar, Jharkhand, Orissa, West Bengal, Assam and plains of North-East States.

The commercialized varieties, together, have yielded a revenue of Rs. 1,28,36,000 (Rs One crore twenty eight lakhs and thirty six thousand). The cascading effect of both technologies had been observed in the primary data, where Punjab was cultivating wheat crop approximately on 35 lakh hectares (2016-17), indicating a major saving of about Rs. 14,343 crores (Rs. Fourteen thousand three hundred and forty three crores) worth of wheat in 2016-17. This was possible due to opting for timely replacement of the old varieties by the new varieties HD 2967 and HD 3086 in 2016. Similarly, the new varieties with the same input practices



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were estimated to have saved Rs. 6,680 crores (Rs Six thousand six hundred and eighty crores) in Haryana's economy in 2016-17 by replacing the old varieties. In terms of wheat grain production, an estimated 8.8 million tonnes of wheat in Punjab and 4.1 million tonnes in Haryana were saved with the adoption of the new wheat varieties HD 3086 and HD 2967, whereas, about 8.8 million tonnes of wheat was potentially lost by Western UP in 2015-16 owing to poor replacement of old wheat varieties. It is important to note that 13.5 million tonnes of wheat food-grain contributed to the food basket of India in a single year (2016-17) with the adoption of HD 2967 and HD 3086.

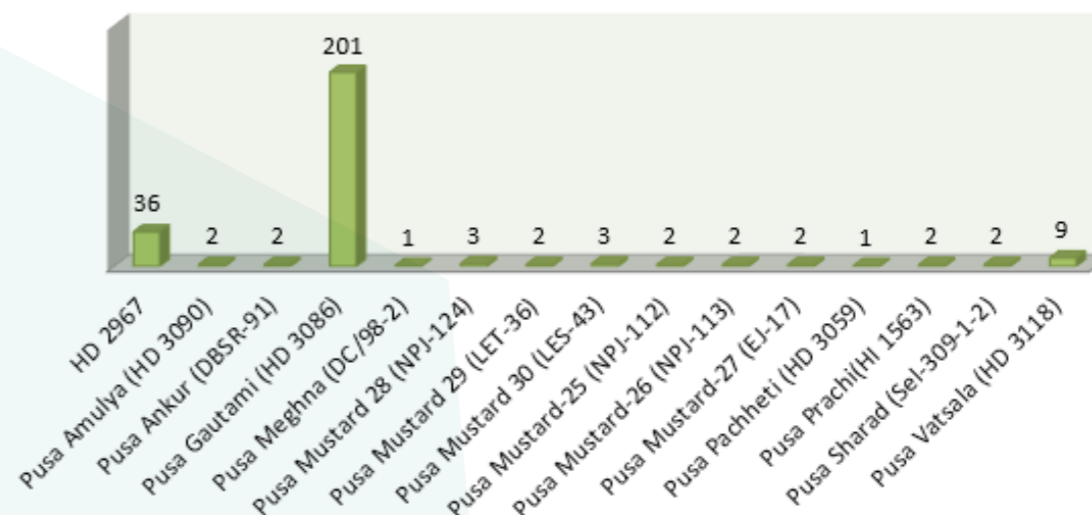


Figure 2.8: Status of licensing of various plant varieties

3.Trademarks

Indian trademark law statutorily protects trademarks as per the ⁸Trademark Act, 1999 and also under the common law remedy of passing off. The objective of the Trademarks Act, 1999 is to register trademarks applied for in the country and to provide for better protection of trademark for goods and services and also to prevent fraudulent use of the mark.

In 2005, the IARI filed its first trademark i.e. PUSA logo in Class 31, which stands for Raw and unprocessed agricultural, aquaculture, horticultural and forestry products; raw and unprocessed grains and seeds; fresh fruits and vegetables, fresh herbs; natural plants and flowers; bulbs, seedlings and seeds for planting in Indian Trademark Registry. Followed by this, in 2012 a word mark i.e. name 'PUSA' was filed by ZTM & BPD Unit as a trademark in total eight (8) classes i.e. 1, 5, 7, 8, 29, 30, 31, 32, and got registered in 2018 (Table 2.5). In 2019, logo of Indian Agricultural Research Institute and word mark 'PUSA' were filed at Indian Trademark Registry for accordance of their status as well-known marks (Table 2.6).

In 2017 the logo and word mark for intellectual property facilitation centre (IPFC) i.e. IP Spectra were filed in

8. The Trademark Act, 1999 deals with the protection, registration and prevention of fraudulent use of trademarks. It also deals with the rights of the holder of the trademark, penalties for infringement, remedies for the damaged as well as modes of transference of the trademark.





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41, 44 and 45 classes and got registration under 44 and 45 classes.

Table No. 2.4: Trademark filings and registration details of logos of IARI during 2005-2020

S. No.	Application No	Trademark	Logo	Class	Filing Date	Registration No.
1.	1333632	PUSA		31	January, 24, 2005	669212
2.	3689085	IP Spectra		45	November 28, 2017	1871306
3.	3689088	IP Spectra		44	November 28, 2017	1922145
4.	3689089	IP Spectra		41	November 28, 2017	-

Table No. 2.5: Trademark filings and registration details of word marks of IARI during 2012-2020

S. No.	Application No.	Trademark	Word Mark	Class	Filing Date	Registration No.
1.	2372150	PUSA	Word mark	1, 5, 7, 8, 29, 30, 31, 32	December 31, 2012	1981304
2.	2796885	flexiCFF	Word mark	9	August 25, 2014	2796885
3.	3689084	IP Spectra: IP Facilitation Centre for Agro based MSME's	Word mark	41	November 28, 2017	1870426
4.	3689086	IP Spectra: IP Facilitation Centre for Agro based MSME's	Word mark	44	November 28, 2017	1904151
5.	3689087	IP Spectra: IP Facilitation Centre for Agro based MSME's	Word mark	45	November 28, 2017	1871813
6.	4399016	JALOPCHAR	Word mark	40	January 06, 2020	-
7.	4399017	JALOPCHAR	Word mark	42	January 06, 2020	-
8.	4399018	JALOPCHAR	Word mark	11	January 06, 2020	2491059



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9.	4430603	ARISE	Word mark	35	February 05, 2020	-
10.	4430604	ARISE	Word mark	41	February 05, 2020	-
11.	4430605	ARISE	Word mark	42	February 05, 2020	-
12.	4430606	SAMARTH	Word mark	41	February 05, 2020	-
13.	4430607	SAMARTH	Word mark	35	February 05, 2020	2529548
14.	4430608	SAMARTH	Word mark	42	February 05, 2020	-
15.	4430609	UPJA	Word mark	41	February 05, 2020	2522790
16.	44306010	UPJA	Word mark	42	February 05, 2020	2523061
17.	44306011	UPJA	Word mark	35	February 05, 2020	2524363
18.	44306012	MAITRI	Word mark	42	February 05, 2020	-
19.	44306013	MAITRI	Word mark	41	February 05, 2020	-
20.	44306014	MAITRI	Word mark	35	February 05, 2020	-

Table No. 2.6: Trademark filings details of well-known marks of IARI from 2005-2020

S. No.	Application No.	Trademark	Well Known Mark	Class	Filing Date
1.	816491	IARI		99	December 26, 2019
2.	816492	PUSA	Word mark	99	December 26, 2019





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4. Copyrights

Teaching is one of the core functions at the universities and research institutions. The intellectual property generated from teaching activities involves publications, books, print media, presentations, flyers, brochures, etc. Such types of intellectual property are protected by copyright. ⁹The Copyright Act, 1957 (as amended by the Copyright Amendment Act 2012) governs the subject of copyright law in India. Thereby, to protect the literary, artistic and software works of IARI and start-ups/ entrepreneurs supported by ZTM & BPD Unit, the Unit manages copyrights' filings and registrations. These copyrights belong to ICAR under the section 4.2.2 of Chapter 5 of '**ICAR Guidelines for Intellectual Property Management and Technology Transfer/ Commercialization**', which states - '*ICAR scientists/innovators shall assign the IP rights in the research results obtained by them to their employer, viz. the 'Indian Council of Agricultural Research'*. Given that innovation is protectable through patents, trade secrets, and plant variety protection, copyright is an area which helps scientists and researchers engaged in agri-innovation at IARI and ICAR to protect their creative intellect through publication, books and other forms. All the publications produced by the institute are protected under the copyright automatically. This right comes into play as soon as the scientist or the staff creates an original piece of work and does not require registration per se.

As of date, eight copyright filings have been made and among them seven have been registered. The copyright registrations were obtained for the software, viz. '*Resources- A Regional Resource Characterizing System*', '*USAR- An EIA Tool for Managing Salt Affected Agricultural Lands And Irrigation Waters*', '*Decision Support System For Soil Health Assessment*', '*Design of 'Micro Irrigation System' (DOMIS)*', '*Infocrop v2.1*', '*Irrigation and Fertigation Scheduler (IFSHED)*' and '*Draksha- Vitismod V1, A Grape Simulaion Model*' created by the ICAR scientists (Table 2.7). As the statistics reveal, two (2) copyrights were obtained in the fiscal year 2013-14. These applications were filed in the previous fiscal year.

9. Copyright law in India is governed by the Copyright Act, 1957, which has been amended six times, with the last amendment in 2012. It is a comprehensive statute providing for copyright, moral rights (known as author's special rights) and neighbouring rights (rights of broadcasting organisations, performers and droit de suite).



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Table 2.7: Copyright filing and registration details during 2011-2020

S. No.	Diary no.	Name of Innovation/ Technology	Date of filing	Registration no.
1.	8863/2011-COSW	Resources-A Regional Resource Characterizing System	July 27, 2011	SW-6754/2013
2.	8864/2011-COSW	USAR-An EIA tool for managing salt affected agricultural lands and irrigation waters	July 22, 2011	SW-6497/2013
3.	13608/2015-CO/SW &	Decision Support System For Soil Health Assessment	December 15, 2015	8955/2016/2016-COSW
4.	5239/2017-CO/SW	Design of 'Micro Irrigation System' (DOMIS)	March 27, 2017	SW-9322/2017
5.	15720/2019-CO/SW	Infocrop v2.1	September 25, 2019	SW-13440/2020
6.	18536/2019-CO/SW	Irrigation and Fertigation Scheduler (IFSHED)	November 21, 2019	SW-13196/2020
7.	11672/2020-CO/SW	Draksha- Vitismod V1, A Grape Simulaion Model	August, 2020	-
8.	21155/2020-CO/SW	Web InfoCrop-Wheat	December, 2020	-

In the fiscal year 2016-17 and 2017-18, registrations were obtained for single applications filed in the previous fiscal years respectively. Copyright is one area, where the scope for work remains limited, since the category of innovations being dealt with can be more suitably protected by other kinds of IPRs and copyrights, in this context, are useful, only when some computer program or algorithm is to be protected. Other creative works like publication, books, print media, etc. are automatically protected after creation. Efforts are being made to give due care to copyrighted materials, as in today's world of internet, anyone from across the world can have access to any copyrighted materials. Therefore, awareness has to be generated in protecting scientific copyrighted information.

IP Spectra

IP Spectra is an Intellectual Property Facilitation Centre (IPFC) for agro-based MSMEs. It was established in 2016 for providing IP services effectively to agro-based MSMEs with the financial support of MSME, Government of India. The mission of IP Spectra is to provide complete IP solution and IP services like Drafting and Filing Applications for Patent, Copyright, Trademark, Industrial Design, PPVFR; Pre-grant and Post-grant Services; hand-holding support towards technology commercialization and Advisory Services to Agri-start-ups and MSMEs as well as to create awareness about the benefits of IPR. The IP Spectra website www.ipspectra.ztmbpd.iari.res.in was launched to reach out to the Agri-start-ups and MSMEs and to create awareness about IP management.

Under this initiative, incubated start-up companies were taught about the importance of Intellectual property management for attaining competitive edge in the global market. During 2017-2020, 125 Incubated start-ups under different incubation programs were mentored individually.

Their intellectual property management strategies were formulated and helped in implementation in the





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interest of their business growth. Based on their IP management strategy, applications for different IP protections were prepared and filed as per table 2.8, 2.9 and 2.10.

1. Patents

Patent applications for incubated start-up companies were prepared and filed under IP Spectra with the following details:

Table 2.8: Patent application filing details from 2017-2020

S. No.	Application No.	Name of Innovation/ Technology	Date of Filing
1.	201711036007	Phytochemical Formulation	October 10, 2017
2.	201911049097	Smart Cane node remover	November 30, 2019
3.	201911054394	Method & Apparatus for Detection of Milk Adulteration	December 30, 2019
4.	202011010000	Feed Pellets and Extruded Floating Feed Pellets Using Insect Protein	March 09, 2020
5.	202011021552	Machine For Nursery Bed Preparation For Rice Seedlings	May 22, 2020
6.	202011021786	Machine For Burning Waste Material	May 24, 2020
7.	202011024985	An Integrated Machine For Lifting, Cleaning, Packing And Loading Harvested Grains	June 15, 2020

2. Trademarks

The lists of trademarks that have been filed/ registered under IP Spectra for incubated startup companies are as following:



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Table 2.9: Trademark application filing details from 2017-2020

S. No.	Application No.	Trademark	Word Mark/ Logo	Class	Registration No.
1.	3668417	Ho Healthy Ho	Logo	44	-
2.	4218507	AEGIPAN	Logo	05	2351831
3.	4218508	AEGIPAN	Logo	39	2344366
4.	4218509	AEGIPAN	Logo	44	2359964
5.	4211224	Dissolved OxygenPlus	Logo	44	2359380
6.	4317357	NeuFaden	Logo	25	4317357
7.	4317358	NeuFaden	Logo	18	4317358
8.	4371405	LfAS	Logo	09	2475858
9.	4413049	BBC Agro Industries Pvt. Ltd.	Logo	07	-
10.	4415413	Sunny Malik	Logo	44	2504246
11.	4526058	IGKV, RABI Raipur (C.G)	Word Mark	35	-
12.	4526059	IGKV, RABI Raipur (C.G)	Logo	41	-
13.	4526060	ABHINAV	Logo	41	-
14.	4526061	UDBHAV	Logo	41	-

3. Copyright

One (1) copyright has been registered with the title 'The Subtext of Anger' having following details.

Table 2.10: Copyright registration details

Registration No.	Name of Innovation\ Technology	Date of Registration
CF-4226/2018	The Subtext of Anger	September 25, 2018





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CHAPTER-3

Detailed Bibliography of Granted Patents of Agri Innovations

Diligent follow up by the IARI, including timely responses of office actions regarding the filed patent applications and payment of other necessary fees, resulted into grant of 70 patents from 1952 till 2020 to ICAR by the Indian Patent Office, whose bibliographic details are given below. The Unit has paid renewal fees too for all the granted patents that are active to maintain them.

"Ideas in your mind have no patent value. They must be expressed or reduced to practice before it is too late."

Specification No. 44194, Application No. 44194, dated 4th December 1950. Complete Specification left on 29th August 1951. (Application accepted 1st May 1952.)

PROVISIONAL SPECIFICATION.

AN IMPROVED DOUBLE BOTTOM COUNTRY PLOUGH.

THE DIRECTOR, INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI, INDIA.

The following specification describes the nature of this invention.

The subject of the invention is to enable the cultivator to carry out his ploughing operations in quicker time but utilizing his same bullock resources.

It is discovered that the draught of two country plough bottoms, if coupled together in a certain way will considerably save the draught required for a single plough bottom.

The double bottom country plough consists therefore of a single iron framework to which two bottoms of standard design are attached and the whole pulled by a single central beam. The bottoms are so spaced in relation to each other that identical furrows are cut and carry out in one operation similar work as would be performed in two operations by a single standard design plough. The framework is so designed that chugging of wheels and lumps of earth with the structural parts of the plough bottoms is avoided.

Attached drawing shows a general arrangement of the framework and plough bottoms.

The double bottom plough is comparatively light, its weight being approximately 20 per cent. heavier than a single plough with a similar bottom and can thus be easily lifted and carried by an average ploughman as required for ordinary operational purposes.

Director,
B. P. PAL,
Indian Agricultural Research Institute,
New Delhi.

Dated this 21th day of November 1950.

COMPLETE SPECIFICATION.

AN IMPROVED DOUBLE BOTTOM COUNTRY PLOUGH.

THE DIRECTOR, INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI, INDIA.

The following specification particularly describes the manner in which it is to be performed.

The present invention relates to the improvement in the existing type of country ploughs which have single bottom attached to the main central beam by a handle for operation by the cultivator. Such ploughs are pulled generally by a pair of oxen and are known to the cultivator in different parts of the country from primitive times.

Prolonged investigations carried out in different farms in India have shown that the draught of two country plough bottoms coupled together to the same central beam, is considerably less than double that required for pulling a single bottom country plough and therefore can easily be used to replace the old conventional type of single bottom country plough to be worked by the same pair of bullocks, without any undue extra strain on the animals. This principle has been carried out into practical effect in the present type of double bottom country plough.

Further, with a view to enable the double bottom country plough to be conveniently stored or lifted away by an average cultivator, as required in ordinary operations, it has been so designed that the weight of the double bottom country plough of the type envisaged in the present invention does not exceed 50 per cent. (about 27 lbs.) of the normal weight of the conventional type of the single bottom country plough which is about 60 lbs. in weight.

The introduction of the above device enables an average cultivator to carry out double the volume of ploughing operation in the same time by employing the same pair of bullocks.

A further advantage of the double bottom plough is that the height of the main central beam, as also the shape, can be adjusted to suit the height of the oxen and the depth of the furrows, depending upon the soil conditions, respectively.

The double bottom country plough according to the present invention comprises a pair of country plough bottoms being secured by means of a metal framework of flat angle iron which is secured to the central beam of the plough, the beam is provided at its rear end with a handle bar for applying the requisite pressure to the plough by the operator. The two bottoms of the double bottom country plough are so spaced apart that two identical parallel furrows are cut in the ground to be cultivated in one single ploughing operation. Further holes are provided in the metal framework for proper adjustment of the height of the central beam to suit the height of the bullocks employed as also for adjusting the depth of the share according to the furrow depth required. The metal framework is made of flat iron to avoid chugging of the plough by weeds, shrubs or lumps of earth with its structural parts, having the two bottoms so spaced apart that identical parallel furrows are cut in

Alternatively or as another embodiment of the invention one or both the bottoms of the double plough may, if required, be replaced by any other desired agricultural implements such as digger, loader, seed drill or the like, for enabling the plough to be used for other agricultural purposes.

The double bottom country plough according to the present invention is illustrated in the drawings accompanying the specification wherein Figure I shows the elevation of the plough and Figure II is a plan. Like reference letters have been used to indicate corresponding components in the different figures of the drawing.

The two bottoms of the double plough are shown at C which are secured in position through the adjusting holes G to the metal framework D which in turn is attached through the iron brackets E to the central beam of the plough B. The rear end of the central beam is attached to another bracket K welded to the framework D. A wooden handle bar H is fixed to the bracket K for the cultivator to apply the requisite pressure during the ploughing operation. The brackets E and K are provided with adjusting holes E and F for fixing the position of the beam to suit the height of the bullocks employed.

The plough according to the present invention has been found to work very satisfactorily for initial ploughing even on grounds with growth of shrubs and weeds. In the case of soft grounds with less or no growth of shrubs and weeds, as also for preparation of land for sowing and mixing of seeds better results are obtained by using single iron for the metal frame work instead of flat iron as illustrated in the drawing.

While the improved plough according to the present invention has been described in the foregoing specification having only two plough bottoms, the same principle can be applied to use a larger number of bottoms with the same set of animals in case of stronger bullocks and to be used only. Similarly the same principle could be applied to use a single plough bottom and two second bottom being operated by any of the other agricultural implement such as loader, digger or seed drill or the like without departing from the spirit and scope of the present invention. The invention therefore should not be understood to be limited in scope by the positive terms employed in connection with the description which could be suitably altered to meet the particular requirements.

I claim

1. A double bottom country plough adjustably secured to the central beam of the plough by means of a metal framework made of flat iron to avoid chugging of the plough on account of weeds, shrubs or lumps of earth with its structural parts, having the two bottoms so spaced apart that identical parallel furrows are cut in

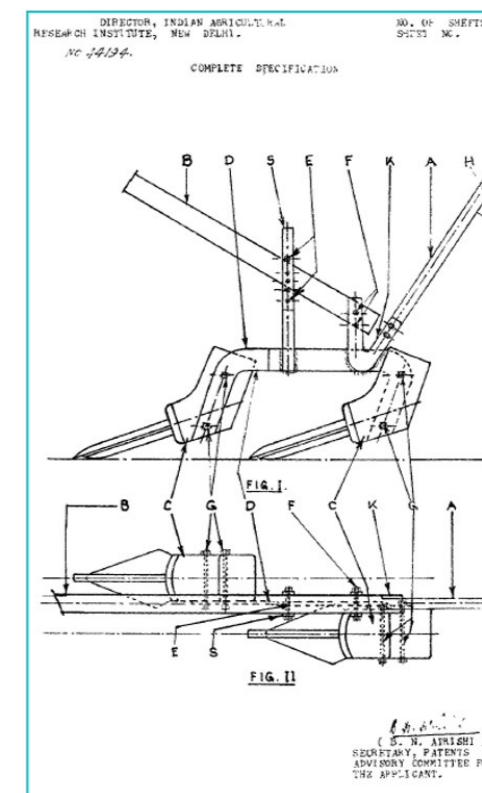
1. Patent Application no.: 44194

Title: An improved double bottom country plough

Date of Filing: December 04, 1950

Granted date: May 01, 1952

Brief about technology: The subject of the invention is to enable the cultivator to carry out his ploughing operations in quicker time but utilizing his same bullock resources.





PATENTED

GOVERNMENT OF INDIA : THE PATENT OFFICE, 214, LOWER CIRCULAR ROAD, CALCUTTA-17. Specification No. 47715. Application No. 47715, dated 21st July 1952. Complete Specification left on 13th April 1953. (Application accepted 22nd September 1953.)

PROVISIONAL SPECIFICATION

IMPROVEMENTS IN OR RELATING TO PREPARATION OF TERPENYL MONO CHLORO ACETATES.

KHUSHHAL CHAND GULATI, ORGANIC CHEMIST AND BASANTA GOPAL CHATTERJEE, RESEARCH ASSISTANT, OF THE DIVISION OF CHEMISTRY, INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI, BOTH SUBJECTS OF THE REPUBLIC OF INDIA.

The following specification describes the nature of this invention.

The invention relates to the preparation of mono-chloro-acetates and its principal object is to provide a simple, economic and efficient process for producing compounds, derived from interaction of bicyclic terpenes (C₁₀H₁₆) and sesquiterpenes (C₁₅H₂₄) obtained directly or indirectly from Indian turpentine oil, with mono-chloro-acetic acid. The compounds, so prepared are important intermediates in the production of organic thiocyanates, used as insecticides for agricultural and public health purposes.

The mono-chloro-acetic acid reacts with the terpenes under suitable conditions of temperature, agitation and with or without the use of catalyst and is converted to terpenyl chloro-acetate.

The object of this invention is to produce certain chloro-acetate compounds, from pinenes, camphene, carenes and longifolene, obtained directly or indirectly from Indian turpentine oil.

The invention comprises in reacting the terpene with mono-chloro-acetic acid, in the presence or otherwise of a condensing agent at temperature up to 140° C. During the reaction, the terpene molecules undergo some isomerization and polymerization, but there are also formed substantial quantities of terpenyl chloroacetates.

To obtain better yields, it has been found economical to use either the terpene or chloroacetic acid in proportions higher than the molar quantities. When the former is used in excess the unreacted terpene can be removed by process of fractional distillation or steam distillation. Terpenes thus recovered, may be used again in the process. Usually after the reaction, the mixture consists of unreacted terpenes, isomerized and polymerized terpenes, terpenyl mono-chloro-acetates and unreacted mono-chloro-acetic acid. Unreacted mono-chloro-acetic acid may be recovered by dissolving it in water, and subsequent concentration and distillation.

K. C. GULATI,

B. G. CHATTERJEE,

Signature of Applicants.

Dated the 6th day of June 1952.

COMPLETE SPECIFICATION

IMPROVEMENTS IN OR RELATING TO PREPARATION OF TERPENYL ESTERS.

KHUSHHAL CHAND GULATI, ORGANIC CHEMIST AND BASANTA GOPAL CHATTERJEE, RESEARCH ASSISTANT, OF THE DIVISION OF CHEMISTRY, INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI, BOTH SUBJECTS OF THE REPUBLIC OF INDIA.

The following specification particularly describes and ascertains the nature of this invention and the manner in which it is to be performed.

The invention relates to the preparation of terpenyl esters and proposes a simple, economic and efficient process for producing compounds, derived from the interaction of bicyclic terpenes (C₁₀H₁₆) and sesquiterpenes (C₁₅H₂₄) obtained directly or indirectly from Indian turpentine oil, with organic acids, e.g., acetic or mono-chloroacetic acid.

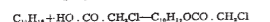
The compounds, so prepared are important intermediates in the production of organic thiocyanates, used as insecticides for agricultural and public health purposes.

Detailed investigations have shown that the above mentioned acids react with the terpenes under suitable conditions of temperature, agitation and with or without the use of catalyst and result in the formation of the terpenyl esters.

The object of the present invention therefore is to produce certain chloroacetate esters from pinenes, camphene, carenes and longifolene, obtained directly or indirectly from Indian turpentine oil.

The present invention comprises in reacting the terpenes with mono-chloro-acetic acid in the presence or otherwise of a condensation agent which serves as a catalyst, at temperatures from 25° C. to 140° C. During the reaction, the terpene molecules undergo some isomerization and polymerization, but simultaneously substantial quantities of terpenyl chloroacetates are also formed during the reaction.

The formation of chloro-acetates may be represented by the following equations:



Terpene Chloro-acetic acid. Terpenyl chloro-acetate



Sesquiterpene Chloro-acetic acid. Terpenyl Chloro-acetate.

The esters thus formed may be purified by steam distillation or fractional distillation. They can also be hydrolysed with basic materials in either aqueous or alcoholic solution with the liberation of terpene alcohols, which after isolation can be converted into chloro-acetates of desired purity.

The following examples are given below by way of illustration:

EXAMPLE 1.

Camphene 230 gms; mono-chloro-acetic acid 150 gms. and sulphuric acid 5 gms. (2 per cent. on the weight of

two rupees.

2. Patent Application no.: 47715

Title: Improvements in or relating to preparation of terpenyl mono chloro acetates

Date of Filing: July 21, 1952

Granted date: September 27, 1953

Brief about technology: The invention relates to the preparation of mono-chloro-acetates and its principal object is to provide a single, economic and efficient process for producing compounds, derived from interaction of bicyclic terpenes (C10H16) and sesquiterpenes (C15H24) obtained directly or indirectly from Indian turpentine oil, with mono-chloro-acetic acid. The compounds, so prepared are important intermediates in the production of organic thiocyanates, used as insecticides for agricultural and public health purposes.



GOVERNMENT OF INDIA : THE PATENT OFFICE, 214, LOWER CIRCULAR ROAD, CALCUTTA-17. Specification No. 48125. Application No. 48125, dated 24th September, 1952. Complete Specification left on 24th June 1953. (Application accepted 27th September 1953.)

PROVISIONAL SPECIFICATION.

A PROCESS FOR THE PRODUCTION OF A MINERAL SUPPLEMENT FOR FOOD FOR THE CATTLE.

THE DIRECTOR, INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI, INDIA.

The following specification describes the nature of this invention.

This invention relates to a process for the production of balanced mineral supplements for the cattle. It includes a method for preparing the said mineral supplement and its modification for use in many kinds of feeding conditions.

The present invention is a process for the production of a mineral supplement for food for the cattle. It includes a method for preparing the said mineral supplement and its modification for use in many kinds of feeding conditions.

B. P. PAL, Director, Indian Agricultural Research Institute, New Delhi, Dated the 16th day of September 1952.

COMPLETE SPECIFICATION.

A PROCESS FOR THE PRODUCTION OF A MINERAL SUPPLEMENT FOR FOOD FOR THE CATTLE.

THE DIRECTOR, INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI, INDIA.

The following specification particularly describes and ascertains the nature of this invention and the manner in which it is to be performed.

This invention relates to a process for the production of balanced mineral supplements for the cattle. It includes a method for preparing the said mineral supplement and its modification for use in many kinds of feeding conditions.

The present invention is a process for the production of a mineral supplement for food for the cattle. It includes a method for preparing the said mineral supplement and its modification for use in many kinds of feeding conditions.

The object of this invention is to provide a simple, economic and efficient process for producing balanced mineral supplements for the cattle. It includes a method for preparing the said mineral supplement and its modification for use in many kinds of feeding conditions.

B. P. PAL, Director, Indian Agricultural Research Institute, New Delhi, Dated the 16th day of September 1952.

GOVERNMENT OF INDIA : THE PATENT OFFICE, 214, LOWER CIRCULAR ROAD, CALCUTTA-17. Specification No. 48429. Application No. 48429, dated 13th November 1952. Complete Specification left on 1st May 1953. (Application accepted 19th August 1953.)

PROVISIONAL SPECIFICATION.

IMPROVEMENTS IN OR RELATING TO PREPARATION OF TERPENYL ETHERS AND ALCOHOLS FROM TURPENTINE OIL.

THE DIRECTOR, INDIAN AGRICULTURAL RESEARCH INSTITUTE, (Pusa), NEW DELHI-12, INDIA.

The following specification describes the nature of this invention.

This invention is by Dr. KHUSHHAL CHAND GULATI of the Chemistry Division of the Indian Agricultural Research Institute, New Delhi, India, and is a process for the production of terpenyl ethers and alcohols from turpentine oil, which have a better water solubility and are more stable than the corresponding compounds prepared by the known process.

The object of the present invention is to provide an efficient and economic method for the production of terpenyl ethers and alcohols from turpentine oil. The present invention is a process for the production of terpenyl ethers and alcohols from turpentine oil, which have a better water solubility and are more stable than the corresponding compounds prepared by the known process.

B. P. PAL, Director, Indian Agricultural Research Institute, New Delhi, Dated the 30th day of September 1952.

COMPLETE SPECIFICATION.

IMPROVEMENTS IN OR RELATING TO PREPARATION OF TERPENYL ETHERS AND ALCOHOLS FROM TURPENTINE OIL.

THE DIRECTOR, INDIAN AGRICULTURAL RESEARCH INSTITUTE, (Pusa), NEW DELHI, INDIA.

The following specification particularly describes and ascertains the nature of this invention and the manner in which it is to be performed.

This invention has been devised by Dr. KHUSHHAL CHAND GULATI, at the Indian Agricultural Research Institute, New Delhi, India.

The invention relates to the production of terpenyl ethers and alcohols from turpentine oil. The present invention is a process for the production of terpenyl ethers and alcohols from turpentine oil, which have a better water solubility and are more stable than the corresponding compounds prepared by the known process.

The main object of the present invention is to provide an efficient and economic method for the production of terpenyl ethers and alcohols from turpentine oil. The present invention is a process for the production of terpenyl ethers and alcohols from turpentine oil, which have a better water solubility and are more stable than the corresponding compounds prepared by the known process.

It has been found that these terpene derivatives are formed by reacting the mixture of the alcohol and water and the acid catalyst with the terpene under suitable conditions of temperature and agitation. The terpene derivatives may be produced from pinenes, carenes and longifolene by the present process. During the interaction, the terpene molecules undergo isomerization, polymerization, and other side reactions.

The reaction may conveniently be carried out by reacting separately the alcohol and the acid catalyst with the terpene under suitable conditions of temperature and agitation. The terpene derivatives may be produced from pinenes, carenes and longifolene by the present process. During the interaction, the terpene molecules undergo isomerization, polymerization, and other side reactions.

B. P. PAL, Director, Indian Agricultural Research Institute, New Delhi, Dated the 30th day of September 1952.



PATENTED



3. Patent Application no.: 48125

TITLE: A process for the production of a mineral supplement for food for the cattle

DATE OF FILING: September 24, 1952

GRANTED DATE: September 07, 1953

Brief about technology: The invention relates to a process for production of balanced mineral supplement for the cattle.

4. Patent Application no.: 48429

TITLE: Improvements in or relating to preparation of terpenyl ethers and alcohols from turpentine oil

Date of Filing: November 13, 1952

Granted date: August 19, 1953

Brief about technology: The object of the present invention is to provide an efficient and economic method for the production of terpene derivatives from bicycle terpenes of the general formula C10H16 and sesquiterpene C15H24 which are important components of Indian oil of turpentine. A further object is to produce these terpene derivatives from pinenes, carenes and longifolene obtained directly or indirectly from the oil of turpentine.



PATENTED

GOVERNMENT OF INDIA : THE PATENT OFFICE, 214, LOWER CIRCULAR ROAD, CALCUTTA-17.
Specification No. 49075, Application No. 49075, dated 2nd March 1953. Complete Specification
left on 12th December 1953. (Application accepted 27th August 1954.)

PROVISIONAL SPECIFICATION.

IMPROVEMENTS IN OR RELATING TO MANURES FROM WOOL AND HAIR WASTES.
 (1) MANGHA ASUDAMAL IDNANI, (2) WASUDEO GOPALRAO WALUNJKAR, CHEMISTRY DIVISION, INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI -12 (INDIA).

The following specification describes the nature of this invention.

This invention relates to the preparation of nitrogenous manure which is obtained in the form of a powder from wool and hair wastes. Considerable quantities of wool and hair wastes are obtained from wool and tannery industries in India and inquiries show that these wastes have found little practical use so far and their disposal is often a problem. The object of this invention therefore is to enable the waste products of these industries to be fruitfully utilized and add to the meagre resources of nitrogenous manures in the country for increased crop production.

It is known that organic fibres of wool and hair are easily attacked by caustic alkalis viz., caustic soda and dimethylamine. The nitrogenous compounds, originally present in the hair or wool, mainly in the form of keratin, are thus hydrolysed into simpler compounds which can then be utilized by the plants as manure. This gelatinous paste when neutralized with dilute mineral acids such as sulphuric acid, gives a spongy precipitate which contains the nitrogenous compounds. The precipitate can be easily dried and reduced into powder possessing high manurial value.

According to the present invention wool and hair wastes are first soaked and washed in water to remove their dirt and then treated with a 10 per cent. solution of caustic soda so as to add 12 per cent. of the alkali on the weight of the wool or hair waste taken. The product is then heated direct or by means of steam under pressure in an Autoclave when it transforms to gelatinous paste. A 10 per cent. solution of sulphuric or other mineral acid is then gradually added to the mix until a spongy precipitate separates out. The residual white liquor is decanted off and the resulting precipitate dried. The product is friable and can easily be converted into a powder which contains about 10-14 per cent. of nitrogen and can be used as manure for the plants.

I. M. A. IDNANI
 W. G. WALUNJKAR.

Dated this 2nd day of January, 1953.

COMPLETE SPECIFICATION.

IMPROVEMENTS IN OR RELATING TO MANURES FROM WOOL AND HAIR WASTES.
 (1) MANGHA ASUDAMAL IDNANI, (2) WASUDEO GOPALRAO WALUNJKAR, CHEMISTRY DIVISION, INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI, SUBURBS OF THE INDIAN UNION.

The following specification particularly describes and ascertains the nature of this invention and the manner in which it is to be performed.

This invention relates to the chemical processing of wool and hair wastes for the production of nitrogenous manures. It is known that these fibres of animal origin contain 10-14 per cent. nitrogen chiefly in the form of resistant keratin. The object of the invention is to transform the complex nitrogenous compounds into simpler forms utilizable by plants and to disintegrate the fibres by chemical treatment which renders them friable and capable of being reduced to a powder.

(i) Wool or hair wastes are first soaked and washed in water to remove dirt and then treated with a 10 per cent. caustic soda solution so as to add 12 per cent. of the alkali on the weight of the raw material. On heating, the fibres are disintegrated, forming a paste. After cooling, a 10 per cent. solution of a mineral acid like sulphuric acid or hydrochloric acid is gradually added until a spongy precipitate separates out from a white liquor. The liquor is decanted off and the precipitate dried in the sun or with hot air. This product is then easily friable and can be broken down to a uniform powder which may contain 10-14 per cent. nitrogen. The material can then be used as a nitrogenous manure.

(ii) The treatment can be economized by subjecting the materials to the action of caustic soda added at the rate of 4 per cent. on the weight of the material and then steaming at a pressure of 25 pounds per square inch for 20 minutes in an autoclave. The paste obtained is then further treated as in (i) above.

We claim:

1. A process for the production of nitrogenous manure from wool and hair wastes wherein partial disintegration of the material is brought about by treatment with 12 per cent. of caustic soda on the weight of the material followed by re-precipitation of a spongy material, by the addition of any mineral acid.
2. A process for the production of nitrogenous manure from wool and hair wastes as in Claim (1), wherein the initial disintegration of the materials is brought about by the addition of at least 4 per cent. caustic soda on the weight of the material, followed by steaming at a pressure of 25 pounds per square inch for 20 minutes.

I. M. A. IDNANI
 W. G. WALUNJKAR.

Dated 10th December 1953.
 Price: TWO RUPEES.

5. Patent Application no.:49075

Title: Improvements in or relating to manures from wool and hair wastes

Date of Filing: March 02, 1953

Granted date: August 27, 1954

Brief about technology: The invention relates to the preparation of nitrogenous manures which is obtained in the form of a powder from wool and hair waste. Considerable quantities of wool and hair wastes are obtained from wool and tannery industries in India and inquiries show that these wastes have found little practical use and their disposal is often a problem. The object of this invention therefore is to enable the waste products of these industries to be fruitfully utilized and add to the meagre resources of nitrogenous manures in the country for increased crop production.



PATENTED

GOVERNMENT OF INDIA : THE PATENT OFFICE, 214, LOWER CIRCULAR ROAD, CALCUTTA-17.
Specification No. 49771, Application No. 49771, dated 22nd June 1953. Complete Specification
left on 24th March 1954. (Application filed 17th November 1954.)

PROVISIONAL SPECIFICATION.

IMPROVED GROUNDNUT PLANTER.
 THE DIRECTOR, INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI, INDIA.

The following specification describes the nature of this invention.

This invention relates to sowing machine particularly adapted to groundnut planting. It is well-known that groundnut sowing care has to be taken to ensure that the groundnut seed does not get injured. In the groundnut sowing process, the groundnut seed is often injured due to the fluted roller type seed drills at present available. The object of the present groundnut planter is to avoid such injury to the groundnut kernel intended for sowing. A planter has therefore been developed which provides a method of sowing groundnut seeds in a row under the ground. The planter is so designed that the groundnut seeds are sown into the furrow made by a furrow or through a sowing tube. The sowing tube is driven down the soil through the groundnut roller and drops the groundnut seeds into the furrow made by the furrow or through the sowing tube. The number of seeds in the sowing tube is fixed when and where the roller is in the furrow.

I. P. PAL,
 Director,
 Indian Agricultural Research Institute,
 New Delhi-12.

Dated the 20th day of May 1953.

COMPLETE SPECIFICATION.

IMPROVED GROUNDNUT PLANTER.
 THE DIRECTOR, INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI, INDIA.

This invention has been invented by SHRI I. P. PAL, THE DIRECTOR, INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI, AND SHRI B. V. BHALLANI, THE HEAD OF THE DIVISION OF AGRICULTURAL ENGINEERING AT THE INDIAN AGRICULTURAL RESEARCH INSTITUTE.

The following specification particularly describes and ascertains the nature of this invention and the manner in which it is to be performed.

This invention relates to sowing machine particularly adapted to groundnut planting. It is well-known that groundnut sowing care has to be taken to ensure that the groundnut seed does not get injured. In the groundnut sowing process, the groundnut seed is often injured due to the fluted roller type seed drills at present available. The object of the present groundnut planter is to avoid such injury to the groundnut kernel intended for sowing. A planter has therefore been developed which provides a method of sowing groundnut seeds in a row under the ground. The planter is so designed that the groundnut seeds are sown into the furrow made by a furrow or through a sowing tube. The sowing tube is driven down the soil through the groundnut roller and drops the groundnut seeds into the furrow made by the furrow or through the sowing tube. The number of seeds in the sowing tube is fixed when and where the roller is in the furrow.

When the roller is in the furrow, the groundnut seeds are sown into the furrow made by the furrow or through the sowing tube. The sowing tube is driven down the soil through the groundnut roller and drops the groundnut seeds into the furrow made by the furrow or through the sowing tube. The number of seeds in the sowing tube is fixed when and where the roller is in the furrow.

I. P. PAL,
 Director,
 Indian Agricultural Research Institute,
 New Delhi-12.

Dated the 20th day of May 1953.

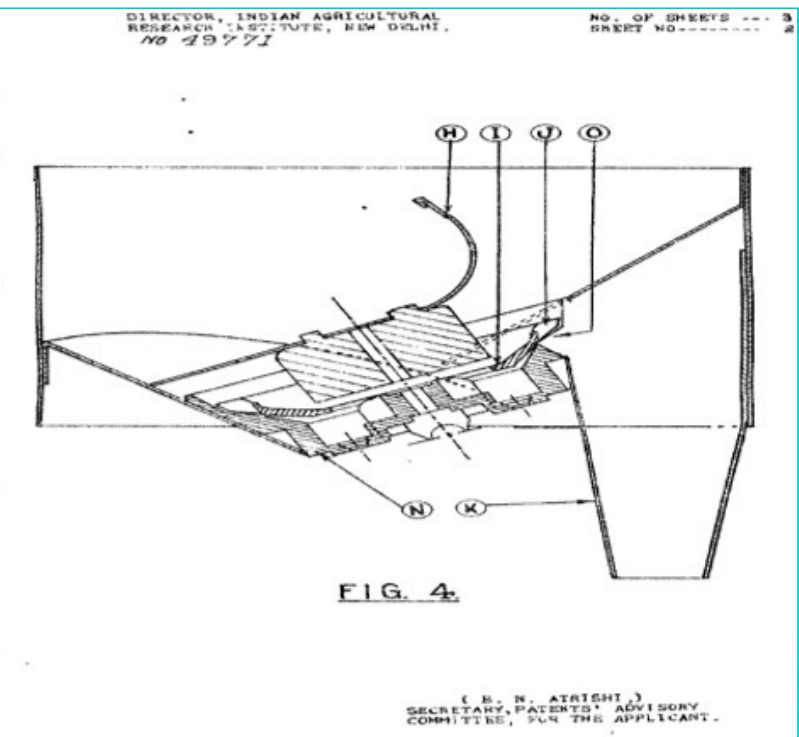
6. Patent Application no.: 49771

Title: Improved groundnut planter

Date of Filing: June 22, 1953

Granted date: November 17, 1954

Brief about technology: The invention relates to sowing machine particularly adopted to groundnut planting. It is well-known that in groundnut sowing care has to be taken to ensure what the groundnut seed (kernel) does not get injured. In all the fluted roller type seed drills at present available, the groundnut seed (kernel) gets badly crushed or damaged. The object of the present groundnut planter is to avoid such injury to the groundnut kernels intended for sowing.





PATENTED



PATENTED

GOVERNMENT OF INDIA : THE PATENT OFFICE, 214, LOWER CIRCULAR ROAD, CALCUTTA-17.
 Specification No. 52580, Application No. 52580, dated 20th August 1954. Complete Specification
 left on 29th April 1955. (Application accepted 20th February 1956.)

PROVISIONAL SPECIFICATION
 IMPROVEMENTS IN OR RELATING TO PREPARATION OF TERPENE THIOCYANATES FOR USE AS
 INSECTICIDES.

THE DIRECTOR, INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI, INDIA.

The following specification describes the nature of this invention.

This invention relates to the production of insecticides for agricultural and public health purposes. More particularly it relates to the preparation of terpene thiocyanates from terpene esters and ethers.

Some of the terpene thiocyanates are known to have potent insecticidal properties. They are noted for their high knock-down effect and also act as synergists for other insecticides. The present invention aims to produce them in the country with the available indigenous raw materials. To achieve the terpenes and essential terpenes of the formulae (I), (II) and (III), the terpenes which are readily available from Indian vegetation and also from the starting raw material for the present invention.

According to this invention, the terpenes, esters, terpenyl acetates, terpenyl ethers or terpenyl thioacetates dissolved in any of the lower alcohols or ketones such as methyl, ethyl, n-butyl, acetone, etc.

B. P. PAL,
 Director,
 Indian Agricultural Research Institute,
 New Delhi.
 Dated this 25th day of June 1954.

COMPLETE SPECIFICATION
 IMPROVEMENTS IN OR RELATING TO PREPARATION OF TERPENE THIOCYANATES FOR USE AS
 INSECTICIDES.

THE DIRECTOR, INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI, INDIA.

The following specification particularly describes and explains the nature of this invention and the manner in which it is to be performed.

This invention has been developed at the Indian Agricultural Research Institute, New Delhi, and is described in the following terms:

It is known that certain terpenoids (about 80 per cent. of the total terpenoids) are present in the essential oils of various plants and are known to have potent insecticidal properties. They are noted for their high knock-down effect and also act as synergists for other insecticides. The present invention aims to produce them in the country with the available indigenous raw materials. To achieve the terpenes and essential terpenes of the formulae (I), (II) and (III), the terpenes which are readily available from Indian vegetation and also from the starting raw material for the present invention.

According to this invention, the terpenes, esters, terpenyl acetates, terpenyl ethers or terpenyl thioacetates dissolved in any of the lower alcohols or ketones such as methyl, ethyl, n-butyl, acetone, etc.

B. P. PAL,
 Director,
 Indian Agricultural Research Institute,
 New Delhi.
 Dated this 25th day of June 1954.

7. Patent Application no.: 52580

Title: Improvements in or relating to preparation of terpene thiocyanates for use as insecticides

Date of Filing: August 20, 1954

Granted date: February 20, 1956

Brief about technology: The invention relates to the production of insecticides fro agricultural and public health purposes. More particularly it relates to preparation of terpene thiocyanates from terpene esters and ethers.

GOVERNMENT OF INDIA : THE PATENT OFFICE, 214, LOWER CIRCULAR ROAD, CALCUTTA-17.
 Specification No. 74630, filed 22nd December 1960./I Paus 1882 (Saka).
 (Accepted 17th February 1962.)

SEED METERING OR DISTRIBUTING DEVICE FOR SOWING MACHINES, SEED DRILLS, PLANTERS, DIBBLERS.

BENJAMIN PEAREY PAL, DIRECTOR, INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI-12, INDIA, AN INDIAN NATIONAL.

The following Specification particularly describes and explains the nature of this invention and the manner in which it is to be performed:—

This invention relates to a seed metering or distributing device for sowing seeds in the soil.

The object of this invention is to provide a device to facilitate intercultural operation and to permit cross cultivation.

According to this invention a seed metering or distributing device comprises a hopper for the seeds, a seed discharge tube disposed within the hopper with means for raising the seeds to meter the seed tube through an inlet opening, said means comprising an outer member or sleeve slidably disposed around the said discharge tube, a fulcrum handle with a lever for raising and lowering the said sleeve, a cup or channel formed around and with the sleeve, the arrangement being such that when the sleeve is lowered, the seeds are filled in the cup and thereafter the sleeve is raised so that the cup registers with the inlet opening in the said discharge tube and from there the seeds are dropped into the soil.

According to another feature of this invention, the said discharge tube is vertically disposed and the sleeve which is concentrically mounted around the discharge tube is also in the vertical direction. The movement of the sleeve is however limited by a guide slot provided on the sleeve and which is in engagement with a pin mounted on the tube. One or more cups are provided on the sleeve to serve as sowing device for the seeds. The cup is formed generally out of the sleeve wall and has a slanting base so that the seeds enter the opening in the discharge tube when the cup registers with the said opening.

A brush is mounted at the inside of the hopper and is directed towards the inlet opening of the discharge tube, so as to isolate the cup from other seeds contained in the hopper.

Referring to the accompanying drawing, which shows sectional elevation of the device, a discharge tube A is provided within a hopper H. A sleeve B is slidably disposed around and concentric with the discharge tube A. The sleeve B is connected to an operating handle F by means of a spindle S. A cup C is provided on the said sleeve B. The cup has a slanting base so as to enable the seeds contained therein to easily enter through an opening A; provided in the tube A.

The base of the hopper H is secured to the flange I of a base plate which in turn has two extensions I₁ and I₂. The tube A is secured to extension I₁ and the extension I₂ surrounds the lower portion of the sleeve B to serve as a guide for the said sleeve which is slidably disposed within the said tubular extension I₁. Brush D is provided in the hopper to isolate the cup C, from collecting unwanted seeds contained within the hopper.

A guide slot A₂ formed on the sleeve B is engaged by a pin C on the said tube A.

By depressing the handle F in the direction of arrow X the sleeve B is raised and the cup C, comes into registration with the inlet A, whereupon the seeds are discharged from the cup and dropped into the soil.

Price : TWO RUPEES.

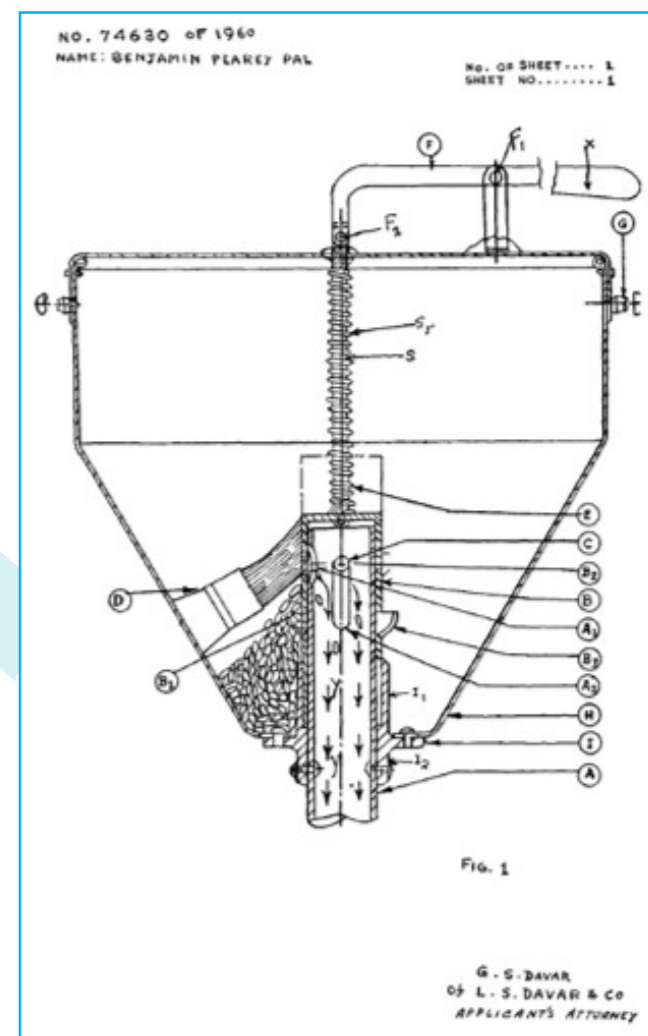
9. Patent Application no.: 74630

Title: Seed metering or distributing device for sowing machines, seed drills, planters, dibblers

Date of Filing: September 22, 1960

Granted date: February 17, 1962

Brief about technology: The invention relates to a seed metering or distributing device for sowing seeds in the soil. The object of this invention is to provide a device to facilitate intercultural operation and to permit cross cultivation.



GOVERNMENT OF INDIA : THE PATENT OFFICE, 214, LOWER CIRCULAR ROAD, CALCUTTA-17.
 Specification No. 57437, 26th May 1956. (Accepted 31st October 1957.)

A PROCESS FOR THE PRODUCTION OF A MINERAL SUPPLEMENT FOR THE CATTLE.

BENJAMIN PEAREY PAL, DIRECTOR, INDIAN AGRICULTURAL RESEARCH INSTITUTE, NEW DELHI, LAXMI SAIJI, DIRECTOR, INDIAN VETERINARY RESEARCH INSTITUTE, VARANASI, U. P. AND KAPISHI CHANDRA SEN, DIRECTOR, INDIAN VETERINARY RESEARCH INSTITUTE, RAJAHMUNDRAM, DISTRICT OF THE PONDICHERRY STATE.

The following specification particularly describes and explains the nature of this invention and the manner in which it is to be performed:

This invention relates to a process for the production of a mineral supplement for the cattle, which can be conveniently added to the feeds of the cattle. The mineral supplement is generally added to the feeds of the cattle and growing cattle.

It is well known fact that in certain areas Indian fields and fodders intended for the cattle are often deficient in minerals, calcium, phosphorus, sodium and iron. It has been accordingly observed that the health of the animals, particularly the milk production, is affected when these minerals are deficient in their feeds. At present the practice is that mineral salts are supplemented to the feeds of the cattle as general supplements. These mineral salts are mineralized according to the formulae based mainly upon the conditions prevailing in foreign countries.

As a result of extensive investigations the mineral requirements of Indian milch cattle feed on various types of feeds and fodders, it is found that most of the milch cattle particularly those yielding about 30 lb. or more of milk per day, soon get into negative balance of the various mineral elements at one stage or the other. The amount of mineral required by the cattle from various sources has been determined. The requirements are considered here in relation to the quantities of different elements which should be supplied to the cattle in order to keep them in positive balance of the various elements at all stages and thus maintain their good health.

The principal object, therefore, of the present invention is to make available a mineral supplement in which the various minerals required for maintaining the health of the cattle are contained in the form of a mixture which can conveniently be obtained and mixed with its feeds.

The proportions of various chemicals which are mixed together to constitute the mineral supplement for the cattle, has been made feasible by the feeding conducted in the various parts of the country.

It is desirable that the health of the milch cattle should be maintained. The health of the milch cattle and generally valuable cattle which yield 20 lb. and more of milk per day and so protect their property from diminishing and thereby promote a healthy growth and development of valuable young cattle.

Yet another object is to make up for the deficiency of minor or trace elements which are now known to affect the health of the cattle and which are not available in normal feed and fodder.

It is known that a mineral supplement containing bone meal, chalk, dicalcium phosphate and common salt (see for instance Ind. Pat. Spec. No. 45121). However the present invention aims at a still better supplement by incorporating it in a smaller bulk in small proportions as well by preparing a different composition which has been found to be the best, for the purpose.

According to this invention, the process for the production of a mineral supplement for replacing the mineral deficiencies generally occasioned in the indigenous feeds and fodders intended for the cattle, in which the bulk of the supplement is formed by bone meal, chalk, dicalcium phosphate and common salt is characterized in that 45 parts of bone meal, 10 parts of chalk, 12 parts of dicalcium phosphate and 30 parts of common salt are mixed together with 5 parts of yellow oxide of iron, 0.75 part of potassium iodide, 0.75 part of sodium chloride, 0.75 part of sodium sulphate, 1.00 part of sodium carbonate (all parts being parts by weight), 100 lb. of the mixture so obtained being then mixed with 5 oz. of manganese sulphate, 4 oz. of copper sulphate and 0.9 oz. of cobalt chloride, to yield the required product.

In addition to this mixture, which has to be added to the cattle feed, extra salt licks may be provided.

In areas where paddy straw is the usual fodder, Manganese sulphate may be omitted from the mineral supplement.

Price : TWO RUPEES.

8. Patent Application no.: 57437

Title: A process for the production of a mineral supplement for the cattle

Date of Filing: May 26, 1956

Granted date: October 31, 1957

Brief about technology: The invention relates to a process for the production of mineral supplement for the cattle, which can be conveniently added to the feeds/rations intended for them with a view to making up for the mineral deficiencies generally occasioned among the Indian milch and growing cattle.





PATENTED



PATENTED

GOVERNMENT OF INDIA: THE PATENT OFFICE, 214, LOWER CIRCULAR ROAD, CALCUTTA-17.

Specification No. 113193, dated 16th November, 1967. Complete specification left on 11th March, 1968. (Accepted 19th July, 1969). Index at acceptance—32F 3C (XII)

PROVISIONAL SPECIFICATION IMPROVEMENTS IN OR RELATING TO THE PRODUCTION OF TERPENE ALCOHOLS FROM TURPENTINE OIL AND ITS COMPONENTS.

The present invention relates to the production of terpene alcohols from turpentine oil and its components, of higher degree of purity and results of higher yields.

The present invention enables the production of terpene alcohols of higher degree of purity and gives higher yield from turpentine oil and its components.

In the hitherto known process for the production of terpene alcohols, the reaction is carried out by treating turpentine oil or its components with a mixture of sulphuric acid, water and alcoholic alcohol (Indian Patent No. 44249 and the

With technological advancement in the country since the earlier patent was taken out, there has been a sizable demand for more grades of terpene alcohols of higher degree of purity as required for preservative coatings, perfumery, dyes and textile industry.

10. Patent Application no.: 113193

Title: Improvements in or relating to the production of terpene alcohols from turpentine oil and its components.

Date of Filing: November 16, 1967
Granted date: July 19, 1969

Brief about technology: The present invention relates to the production of terpene alcohol from turpentine oil and its components, of higher degree of purity and results of higher yields.

GOVERNMENT OF INDIA: THE PATENT OFFICE, 214, ACHARYA JAGADISH BOSE ROAD, CALCUTTA-17.

Specification No. 113909, Filed 3rd January, 1968. (Application Accepted 20th June, 1969). Index at Acceptance—123(H4)

"A PROCESS FOR THE PREPARATION OF ENRICHED PHOSPHATIC FERTILIZER FROM LOW GRADE BASIC SLAG"

This invention relates to enrichment of low grade basic slag so as to obtain a phosphoric acid content of 12 to 20 percent in them and make the products utilizable as phosphatic fertilizer. Basic slags obtained as waste product from the Steel industry normally contain 12 to 20 percent phosphoric acid (P₂O₅) and are utilized as phosphatic fertilizer in agriculture.

The object of the present invention is to increase the phosphoric acid content of such slag to 12 to 20 percent so as to make the product economic to extract and utilize as phosphatic fertilizer in agriculture. Accordingly this invention provides a process for the preparation of enriched phosphatic fertilizer from low grade basic slag obtained as waste product from the Steel industry which comprises the following steps:

- (1) Dissolving bones or rock phosphate in hydrochloric acid or sulphuric acid.
- (2) Carrying out further neutralization to pH 5.5 with a solution of sodium carbonate or lime.
- (3) Filtering to remove soluble chlorides and dry.
- (4) In the case of sulphuric acid being used to dissolve rock phosphate or bones, drying the product directly after adding basic slag.

The process thus provides for (a) bones or rock phosphate to be rendered soluble by the action of a mineral acid and then incorporated in low grade basic slag then enriching it in phosphoric acid (P₂O₅) content to 12 to 20 percent and (b) the hygroscopic chlorides formed from hydrochloric acid being removed by filtration to give the product good storage property. The enriched basic slag can then be economically utilized as a phosphatic fertilizer.

11. Patent Application no.: 113909

Title: A process for the preparation of enriched phosphatic fertilizer from low grade basic slag.

Date of Filing: January 03, 1968
Granted date: June 20, 1969

Brief about technology: This invention relates to enrichment of low grade basic slags so as to obtain a phosphoric acid content of 12 to 20 percent in them and make the products utilizable as phosphatic fertilizer. Basic slags obtained as waste product from the Steel industry normally contain 12 to 20 percent phosphoric acid (P₂O₅) and are utilized as phosphatic fertilizer in agriculture.



GOVERNMENT OF INDIA: THE PATENT OFFICE, 214, LOWER CIRCULAR ROAD, CALCUTTA-17.

Complete Specification No. 115716 dated on 3rd May, 1968 (Accepted 18th August, 1969). Index at acceptance—32F 1+3a(XI)

IMPROVEMENTS IN OR RELATING TO MANUFACTURE OF TERPENYL ESTERS

The present invention has been evolved and developed by Dr. Khashab Chand Gulati and Shri. Swadesh Kumar Hunda, employees of the Indian Agricultural Research Institute, New Delhi.

The principal object of the present invention is to propose a process for the manufacture of terpenyl esters of lighter colors which would give products of lighter shade when used in protective coating or in perfumery industry.

The principal object of the present invention is to propose a process for the manufacture of terpenyl esters of lighter colors which would give products of lighter shade when used in protective coating or in perfumery industry.

According to this invention terpenyl esters are prepared by reacting organic acids and phosphoric acid to yield esters of higher molecular weight than those obtained by the reaction of organic acids with phosphoric acid.

GOVERNMENT OF INDIA: THE PATENT OFFICE, 214, ACHARYA JAGADISH BOSE ROAD, CALCUTTA-17.

Specification No. 121303, Application No. 121303, dated 13th May, 1969. Complete Specification left on 29th December, 1969. (Application accepted—10th July, 1970). Index at acceptance—55D2 (XIX(1))

PROVISIONAL SPECIFICATION IMPROVEMENTS IN OR RELATING TO AGRICULTURAL PESTICIDES MORE PARTICULARLY THOSE CONTAINING BARIUM POLYSULPHIDE AND TOBACCO ALKALOIDS

This invention relates to agricultural pesticides more particularly those containing barium polysulphide and tobacco alkaloids.

The present invention enables the production of barium polysulphide in a solid state admixed with other conventional materials such as carbon, barium sulphate and plant matter in powder state.

This invention has been evolved and developed by Dr. Khashab Chand Gulati, Late Dr. Purna Lal Kapoor and Shri. Mahesh Datt Awasthi, all employees of the Indian Agricultural Research Institute, New Delhi.

The principal object of the present invention is to propose a triple action pesticide from barium polysulphide which could serve simultaneously as a fungicide, acaricide or miticide as well as an insecticide.

12. Patent Application no.: 115716

Title: Improvements in or relating to manufacture of terpenyl esters

Date of Filing: May 03, 1968
Granted date: August 18, 1969

Brief about technology: The object of the invention is to overcome the shortcoming of the formation of dark brown color during production of terpenyl esters as mentioned in Indian Patent no. 47715 by stipulating the preparation of terpenyl esters of lighter colors which also results in better yields.

13. Patent Application no.: 121303

Title: Improvements in or relating to agricultural pesticides more particularly those containing barium polysulphide and tobacco alkaloids

Date of Filing: May 13, 1969
Granted date: July 10, 1970

Brief about technology: This invention relates to agricultural pesticides more particularly those containing barium polysulphides and tobacco alkaloids.





PATENTED



PATENTED

GOVERNMENT OF INDIA : THE PATENT OFFICE, 214, ACHARYA JAGADISH BOSE ROAD, CALCUTTA-17.

Specification No. 128129, Application No. 128129, dated 21st August, 1970. (Divided act of No. 119536). [Anti-dated to 24th January, 1969 Under Section 5 of the Indian Patents and Dividing Act, 1911]. Complete specification left on 21st August, 1970. (Application accepted—24th October, 1970). Index at acceptance—32F3a [X(1)]

PROVISIONAL SPECIFICATION

"IMPROVEMENTS IN OR RELATING TO METHYLENEDIOPHYENYL DERIVATIVES"

THE DIRECTOR, INDIAN AGRICULTURAL RESEARCH INSTITUTE, DELHI-12, INDIA, AN INDIAN NATIONAL.

The following Specification describes the nature of this invention—

This invention relates to Methyleneoxyphenyl derivatives which constitute economical and efficient synergists for pyrethrins and more particularly to methylenedioxyphenyl derivatives containing at least a three-carbon side chain on the benzene nucleus, a methylenedioxy group at the 3, 4 positions and two methoxy groups at positions 5 and 6 of the nucleus. It has been developed at the Indian Agricultural Research Institute jointly by Dr. Khimbal Chand Goyal, Head of the Division of Agricultural Chemistry and Sri Balraj Singh Parmar, a research scientist of the Division of Agricultural Chemistry of the said Institute.

Pyrethrins are probably known to be the most expensive of insecticides and a greater bulk (about 80% of active ingredients) of the pyrethrin flowers for the production of pyrethrins need insecticides as well as all the synergists for pyrethrins are being obtained by imports in this country. The principal object of this invention is to develop indigenous production of synergists in the country. Another object is to substantially reduce the imports of pyrethrin flowers generally used in formulating pyrethrin based insecticides in the country and thus to bring about an effective saving in the foreign exchange of the country.

It is known that good synergists for pyrethrins, usually contain methylenedioxyphenyl group coupled with a side chain containing ether linkage. Among the ether groups it is also known that allyl ether grouping has significant biological activity and broad stability. According to the proposed invention, the di-allyl ether, having the structural formula as shown in Fig. 1, isolated from the essential oil of *Asarum arvense* Lam. (Umbelliferae), is found to be a useful synergist as well as a good starting material for the production of synergists of improved quality used in pyrethrin based formulations. The di-allyl ether, isolated from the di-allyl ether obtained from *Asarum arvense* is considered to be undisturbed from the point of view of the pharmaceutical usage of the oil used in the manufacture of curative preparations for infants and flowering herbs, our investigations have shown that this compound has useful properties as a synergist as also for the production of improved quality of synergists for pyrethrins.

Table I
Factor of synergism* of the compounds on *Musca domestica* L. (4 days old)

Spray Mixture	Py : Syn.	No. of replicates	%Py conc. for 50% K.E.* in 2 min.	Factor of synergism
Pyrethrins	—	5	0.04109	—
Pyrethrins+	1 : 4	5	0.01349	3.09
Dill apole	1 : 8	5	0.02791	1.82

Price : TWO RUPEES

14. Patent Application no.: 128921

Title: Improvements in or relating to

methyleneoxyphenyl derivatives

Date of Filing: August 21, 1970

Granted date: October 24, 1970

Brief about technology: The invention relates to Methyleneoxyphenyl derivatives which constitute economical and efficient synergists for pyrethrins and particularly to methylenedioxyphenyl derivatives containing at least a 3-carbon side chain on the benzene nucleus, a methylenedioxy group at the 3, 4 positions and two methoxy groups at positions 5 and 6 of the nucleus.

Government of India, The Patent Office, 214, Acharya Jagdish Bose Road, Calcutta-17. Complete specification No. 137624 dated 14th May 1974. Application No. 1063/CAL/1974 dated 14th May 1974. Acceptance of complete specification advertised on 23rd August 1974.

Index at acceptance - 32 F 1 [X(1)]

Information classification - A 01 n 7/34.

"An improved method for preparation of 1,1-di-(4-chlorophenyl)-2,2,2-trichloroethanol".

The Director, Indian Agricultural Research Institute, New Delhi-110012, an Indian National.

The following specification particularly describes and ascertains the nature of the invention and the manner in which it is to be performed—

16. Patent Application no.: 1063/CAL/1974

Title: An improved method for

preparation of 1,1-di-(4-chlorophenyl)-2,2,2-trichloroethanol

Date of Filing: May 14, 1974

Granted date: August 23, 1975

Brief about technology: The invention relates to the preparation of 1,1-di-(4-chlorophenyl)-2,2,2-trichloroethanol commonly known as Dicofol or Kelthane from 1,1-di-(4-chlorophenyl)-1,2,2,2-tetrachloroethane for use as an acaricide and synergist for various type of DDT formulations.

GOVERNMENT OF INDIA : THE PATENT OFFICE, 214, ACHARYA JAGADISH BOSE ROAD, CALCUTTA-17.

Complete Specification No. 133090, Application and Complete Specification Filed on 1st Oct., 1971. (Acceptance advertised on 16th September, 1972). Index at Acceptance—32F1 [X(1)]

IMPROVEMENTS IN OR RELATING TO PREPARATION OF 2, 2, 2-trichloro-1, 1-di-(4-CHLOROPHENYL) ETHANOL.

The Director, Indian Agricultural Research Institute, New Delhi-12, an Indian National.

The following Specification particularly describes and ascertains the nature of this invention and the manner in which it is to be performed—

This invention has been evolved and developed by Sanjay Kumar Singh Tomer, Nipendra Kumar Roy, Smit Kumar Mukherjee and Khimbal Chand Goyal of the Division of Agricultural Chemistry, an employee of the Indian Agricultural Research Institute, New Delhi-12.

This invention relates to preparation of 2, 2, 2-trichloro-1, 1-di-(4-chlorophenyl) ethanol from 1, 1-di-(4-chlorophenyl)-2, 2, 2-trichloroethane for use as an acaricide as well as a synergist for various types of D.D.T. formulations. This particular ethanol is found to be a potent acaricide and also a synergist for 1, 1-di-(4-chlorophenyl)-2, 2, 2-trichloroethane (D.D.T.) and other related insecticides. It has been mainly improved from alcohol. The improved material generally sold as a viscous brown oil, is seldom very pure. It contains about 55% of the active ingredients. The basic raw material for its production being D.D.T., the promotion of its production in the country will not only bring about a saving in the foreign exchange but will also diversify the uses of D.D.T., which are in the process of being curtailed. It would further help economizing on the use of chlorinated insecticides and thus reduce the hazards which are generally associated with their use.

The conversion of 1, 1-di-(4-chlorophenyl)-2, 2, 2-trichloroethane (I) to 2, 2, 2-trichloro-1, 1-di-(4-chlorophenyl) ethanol (II) according to the present invention may be represented through the transient formation of ion (III) as illustrated in the accompanying drawing.

It is already known that the ethanol (II) can be prepared from (I) in two ways. The first method consists of treating the trichloroethane (I) with silver acetate in acetic acid followed by hydrolysis of the resulting acetate. This process however, is very costly and therefore cannot be adopted for commercial production.

In the second method the product indicated as (I) is heated with a mixture of sulfuric acid and water in the presence of p-toluenesulfonic acid as catalyst when the product shown as (II) is obtained. The yield, however, of the end product in the present case is not satisfactory.

The production of (II) from (I) may be carried out by reacting (I) with the required quantity of mercuric acetate in acetic acid (solvent), sulfuric acid and water in the presence of a catalytic catalyst, containing aluminum as one of its constituents. Some of the catalysts which may be conveniently used for this purpose may be ammonium salts, secondary ammonium compounds, organic bases like pyridine, quinoline, imidazole, alkyl and aryl amines, acids containing amino group in acetic acid like sulfonic acid and amino acids like glycine. The temperature of the reaction mixture may be maintained between 115-140°C for the period ranging between 5-10 hours at atmospheric pressure. The amount of sulfuric acid in the solvent mixture can be reduced and a cleaner product may be obtained in a much shorter period of time by heating under super atmospheric pressure, say upto 15 atmospheres.

The reaction product may then be freed of some excess

of sulfuric acid and water by heating under reduced pressure and thereafter pouring the reaction products with stirring into cold water, when (II) solidifies and can be filtered off. It yields a product of brownish colour which contains a proportion of nearly 80% of the desired product. The product of this purity is found to be good enough for most of its uses.

However, if a product of higher purity is desired, it can be obtained from the crude material after washing with water, drying and dissolving in some hydrocarbon solvent, thereafter passing it through a column of alumina and removing the solvent by evaporation.

The desired material (II) can also be obtained from (I) without the use of any catalyst by reacting it with required quantities of the reaction mixture. In this case the yield of the product is low and time required is unduly long.

The quantity of the catalyst employed may vary with the nature of the catalyst employed.

The progress of the reaction and the purity of the product was determined by thin layer chromatography on silica gel plates using petroleum ether : benzene (95 : 5) as developer solvent and silver nitrate-ethanolamine spray as the visualising agent. The results have shown that both glycine and ammonium sulfate are good catalysts for the present preparation. Although ammonium sulfate is cheaper in cost, glycine yields a pure product in a little shorter time.

Thus the principal object of the present invention is to set up indigenous production of an acaricide as well as a synergist for D.D.T. and the related insecticides and thus increase import substitutes in the field of agriculture. Since D.D.T. has a longer residual life, any method by which its efficacy is increased will be a desirable one to be applied and will thus reduce the hazards which are generally associated with its use. Moreover, production of this new chemical using D.D.T. as the raw material will diversify the industry. This is of importance as D.D.T. industry is the only large scale insecticide industry in the country and if there is a ban on its use at any future date, other outlets for this chemical will have to be found.

According to the present invention the process for preparation of 2, 2, 2-trichloro-1, 1-di-(4-chlorophenyl) ethanol comprises in reacting 1, 1-di-(4-chlorophenyl)-2, 2, 2-trichloroethane in acetic acid as solvent with a mixture of sulfuric acid and water with or without the presence of a catalytic catalyst, containing nitrogen as one of its constituents by heating between 115°C-140°C for a period ranging from 5 to 10 hours at pressures ranging from atmospheric pressure to about 15 atmospheres, thereafter removing excess of the solvent under reduced pressure and obtaining the required product by treating the resultant mixture with cold water and filtering the precipitate.

The following examples illustrate the manner in which the desired product may be achieved according to the proposed invention—

Price : Rs. Two Only.

15. Patent Application no.: 133090

Title: Improvements in or relating to preparation of 2, 2, 2-trichloro-1, 1-di-(4-chlorophenyl) ethanol

Date of Filing: October 01, 1971

Granted date: September 16, 1972

Brief about technology: The invention relates to preparation of 2, 2, 2-trichloro-1, 1-di-(4-chlorophenyl) ethanol from 1,1-di-(4-chlorophenyl)-1, 2, 2, 2-tetrachloroethane for use as an acaricide as well as a synergist for various types of D.D.T formulations.

GOVERNMENT OF INDIA : THE PATENT OFFICE, 214, ACHARYA JAGADISH BOSE ROAD, CALCUTTA-17. Complete specification No. 137906, dated 27th June 1974. Application No. 1442/CAL/74, dated 27th June 1974. Acceptance of the complete specification advertised on 17th October 1975.

Index at acceptance - 32 F 2 [X(1)]

International classification - C 07 C 57/17

"Improvements in or relating to preparation of alpha-substituted 3,4-methylenedioxyphenyl derivatives as synergists for pyrethrins."

The Director, Indian Agricultural Research Institute, New Delhi-110012, India, an Indian National.

The following specification particularly describes and ascertains the nature of this invention and the manner in which it is to be performed—

17. Patent Application no.: 1442/CAL/74

Title: Improvements in or relating to preparation of alpha-substituted 3,4-methylenedioxyphenyl derivatives as synergists for pyrethrins

Date of Filing: June 27, 1974

Granted date: October 11, 1975

Brief about technology: This invention relates to methylenedioxyphenyl derivatives which constitutes a potent group synergists for pyrethrins and carbamates and more particularly to the condensation products of an aromatic aldehyde bearing a methylenedioxy function with reactive aliphatic carbonyl compounds such as aliphatic aldehydes or anhydrides to get the desired cinnamoyl derivatives having alkyl (C1-C8) substituents at the alpha carbon atom.

This invention relates to methylenedioxyphenyl derivatives which constitute a potent group of synergists for pyrethrins and carbamates and more particularly to the condensation products of an aromatic aldehyde bearing a methylenedioxy function (e.g. piperonal) with reactive aliphatic carbonyl compounds such as aliphatic aldehydes or anhydrides to get the desired cinnamoyl derivatives having alkyl (C₁-C₈) substituents at the alpha carbon atom. These condensation products in form as well as pure form, have been found to be potent synergists for pyrethrins.

This invention has been developed at the Indian Agricultural Research Institute, New Delhi-110012, India, jointly by Dr. Balraj Singh Parmar, Chemist, Dr. Hanumant Singh, Assistant Chemist, Dr. Satish Chandra Gupta, Senior Research Fellow, Dr. Shree Singh, Senior, Junior Technologists, Mr. Rajendra Prasad Singh, Senior Research Assistant (Technology) and Dr. Rishi Kumar Mukherjee, Head, all of Division of Agricultural Chemistry, Indian Agricultural





PATENTED

18. A Multi/Hyper-Spectral Data Analyzing Process For Complete Quantification, Characterization And Compression Of Natural Resource Specific Information

Patent Number	214697
Date Of Certificate Issue	14/02/2008
Post Grant Journal Date	29/02/2008
Publication Number	49/2005
Publication Date	23/12/2005
Publication Type	INA
Application Number	825/DEL/2001
Application Filing Date	02/08/2001
Field Of Invention	COMPUTER SCIENCE
Classification (IPC)	G01J 3/28
Inventor	DR. (MRS) RAVINDER KAUR

Abstract:

In remote sensing earth features are primarily characterized through multi-spectral signatures, recorded either as per cent reflectance or gray levels in different wavebands. However, in order to make characterization quantitative and more specific some spectral indices derived from information in these spectral channels/wavebands are often used, which compress the data partially in two or more selected wavebands. Data analysis of simple gray scale, color, and color-infrared images is fairly straightforward. Current techniques for analysis of Landsat-7 band images are adequate, but there are currently no methods for analysis of hyper-spectral data that are both powerful and fast. Current methods tend to either: 1) Revert hyper-spectral images to Landsat channels; 2) Rely on information from a few selected bands; or 3) Explore the entire spectrum through complex data analysis procedures such as Partial Least Squares (PLS), whose computational requirements increase with the square of the data's dimension (i.e. number of spectral channels). In fact all these techniques are based on a simple assumption that some wavelengths or portions of the spectrum are rich in information about a feature of interest while the others are poor. Thus all these techniques totally ignore the fact that the spectrum as a whole has another dimension of information that is lost in treating it as discrete channels. Besides this, all these techniques involve complicated class-separability and clustering analysis in n-dimensional space; where «n» is the number of spectral channels. 1 developed a novel, powerful and fast hyper-spectral data analyzing method for quantifying information contained in the whole spectrum, with any number of data/spectral channels from 2 to infinity, of any earth feature based on the basic principles of communication theory. Application of this new hyper-spectral data analyzing method to multi-/ hyper-spectral databases from various platforms, such as field, aircraft & satellite imaging spectrometers has shown that the new method can lead to: 1) Easy identification of previously unrecognized systematic noise in the RDACS/H3 push broom hyper-spectral sensor; 2) Distinct characterization of edges of linear/ non-linear natural/man-made resources such as metallic roads, railway lines, canals, rivers, drains and water- bodies; 3) Distinct characterization of and discrimination between vegetated areas, non- vegetated areas, natural resource mining sites, railway lines, water-bodies, rivers & its tributaries and drains/ canals & their distributaries; 4) Easy discrimination between structural and natural vegetation types thereby leading to more accurate estimates of areas under these vegetation types; 5) Distinct discrimination between soil systems with different physico-chemical characteristics; 6) Distinct characterization and discrimination of different moisture levels in soils; 7) Great reduction in data storage space requirement; and 8) Simplified 1-Dimensional clustering analysis.



PATENTED

19. Process for the Preparation of Pesticidal Oxime Esters

Patent Number	217763
Date Of Certificate Issue	10/04/2008
Post Grant Journal Date	19/09/2008
Publication Number	2/2006
Publication Date	13/01/2006
Publication Type	INA
Application Number	846/DEL/2003
Application Filing Date	27/06/2003
Field Of Invention	PHARMACEUTICALS
Classification (IPC)	A01N 43/00
Inventor	DR.SURESH WALIA, DR. BALRAJ SINGH PARMAR

Abstract:

A process for the preparation of novel pesticidal oxime esters of formula I, RI/ARA-CH=N-OCOR₂/ArB, and formula II, RI/ARA-CH=N-OCO-Arc-COO-N=CH-ARA/RI characterized by the reaction of compounds containing an oxime moiety RI,MA-CHN-O- with compounds comprising of an acyl moiety RI/ArBCO- wherein the reaction is carried out in an organic solvent in a need based presence of a base as catalyst at 15 to 100 OC, and wherein MA, MB and Arc represent substituted or unsubstituted aryl, alkyl, ARalkyl, alkylaryl group(s), and R1 and R2, substituted or unsubstituted parafinic, olefinic or acetylenic group(s), to yield geometrically isomeric compounds of formulae I and II. The configuration around the oxime double bond CH=N, in the molecule being Z or E or both. The application also describes the pesticidal compositions based on the above esters for use in combating mosquito (Culex fatigans), agricultural insect pests namely Spodoptera litura, and Helicoverpa armigera besides some phytophagous fungi and nematodes infecting agricultural crops.





PATENTED

20. Process for The Preparation of Mono/Di/Polyol Ester Pesticides

Patent Number	218031
Date Of Certificate Issue	29/04/2008
Post Grant Journal Date	09/05/2008
Publication Number	39/2007
Publication Date	28/09/2007
Publication Type	INA
Application Number	847/DEL/2003
Application Filing Date	27/06/2003
Field Of Invention	CHEMICAL
Classification (IPC)	A01N 27/00
Inventor	DR. PARAJ SHUKLA, DR. BALRAJ SINGH PARMAR, DR. SURESH WALIA

Abstract:

The invention relates to the development of a process for the preparation of novel pesticidal mono-, di- and/or polyol esters characterized by the reaction of compound(s) containing the diol or polyol moiety with another compound containing acyl moiety RCO- and/or aroyl moiety ArCO- wherein the reaction is carried out in an inert aprotic solvent and a need based presence of a catalyst at temperature range of 15-100 °C and wherein the linkage in reference is formed as a result of condensation of these moieties. These compounds are either mono-, di-, tri- or poly alkanate or mixture of two or more of such products. The compounds either as such or in different solid or liquid formulations exhibit considerable activity against different pests particularly the root knot nematode Meloidogynae incognita, reniform nematode Rotylenchulus reniformis, and phytophagous fungi Rhizoctonia solani and Sclerotia rolfsii infecting agricultural crops.



PATENTED

21. A Process For The Preparation Of Mosquito Larvicidal Formulations Based On Rabdosia Melissoides Ingredients

Patent Number	218311
Date Of Certificate Issue	26/05/2008
Post Grant Journal Date	13/06/2008
Publication Number	4/2006
Publication Date	27/01/2006
Publication Type	INA
Application Number	454/DEL/2001
Application Filing Date	04/04/2001
Field Of Invention	AGROCHEMICALS
Classification (IPC)	A01N 43/00
Inventor	DR. LALIT KUMAR, DR. BALRAJ SINGH PARMAR

Abstract:

The invention relates to the preparation of Emulsifiable Concentrate formulation of the essential oil of Rabdosiamelissoides Benth (Syn. Plectranthusmelissoides Benth) or its chemical ingredients such as thymol, p. cymene or others employing a formulation solvent such as cyclohexanone, aromax, iomax, xylene, ceenine etc. and ionic or non-ionic or blends of ionic, non-ionic and ionic and non-ionic surfactants, and homogenising the product to obtain the final concentrate which is used for pest control after dilution in water to the required strength.





PATENTED

22. A Process For The Production Of Blue Green Algal Biofertilizer

Patent Number	220746
Date Of Certificate Issue	11/07/2008
Post Grant Journal Date	25/07/2008
Publication Number	48/2007
Publication Date	30/11/2007
Publication Type	INA
Application Number	444/DEL/2002
Application Filing Date	10/04/2002
Field Of Invention	MICRO BIOLOGY
Classification (IPC)	A01G 033/00
Inventor	DR. BRAMHA DUTTA KAUSHIK

Abstract:

A process for the production of blue green algal biofertilizer” involves the production of BGA biofertilizer strains individually in the formulated medium by inoculating about 3-10g wet biomass per multiplication unit with a production of 3-10 days production cycle. The medium formulation is achieved by mixing single super phosphate, mureate of potash and magnesium sulphate at 0.02-0.09 g/L water, once BGA cultures grown to a desired biomass say 15-18 g/unit is mixed with wheat/rice straw as carrier at a final population density of 10⁶ -10⁹ cells per gram carrier containing Aulosira, Tolypothrix, Anabaena and Nostoc strains. The multiplication units are constructed in a single/double tier inside the glass or polyethylene house. The multiplication units are made of cement and mortar. In a two-tier system the lower tier is illuminated by artificial light. The temperature of these units is maintained between 25-45°C during the entire year by providing heat convertors in winters and exhaust fans with suitable cloth filters in summer. The dried inoculum containing all the four strains mixed in 1:1:2:2 or 1:1:1:1 (w/w) proportion and packed in suitable size packets. The shelf life of this inoculum (biofertilizer) is two years if stored in dry and well-ventilated area. The straw based biofertilizer to be applied by broadcasting immediately after transplantation of paddy seedlings in a puddled field. Normally 400-g straw-based BGA biofertilizer is enough for 1 acre.



PATENTED

23. Efficient Process For The Preparation Of Neem Based Reduced Azadirachtin(S) Pesticides

Patent Number	226204
Date Of Certificate Issue	15/12/2008
Post Grant Journal Date	02/01/2009
Publication Number	41/2007
Publication Date	12/10/2007
Publication Type	INA
Application Number	1126/DEL/2003
Application Filing Date	09/09/2003
Field Of Invention	CHEMICAL
Classification (IPC)	A01N 43/90
Inventor	SURESH WALIA, VANDANA SHARMA, JITENDRA KUMAR, BALRAJ SINGH PARMAR

Abstract:

A process for the preparation of tetrahydroazadirachtin, and/or dihydroazadirachtin concentrates from azadirachtin concentrates is described. It is characterized by catalytic reduction of azadirachtin under either of ambient or near ambient conditions of temperature and pressure, under continuous stirring, to yield the claimed product(s) in 80 to 100% yields.



PATENTED

24. Improved Process For The Preparation Of Mancozeb

Patent Number	226219
Date Of Certificate Issue	17/12/2008
Post Grant Journal Date	02/01/2009
Publication Number	0258/DEL/2001
Publication Date	09/05/2008
Publication Type	INA
Application Number	0258/DEL/2001
Application Filing Date	07/03/2001
Field Of Invention	CHEMICAL
Classification (IPC)	A01N 47/00
Inventor	DR. N.K. ROY, DR. R.L. GUPTA, A.K. PANDA

Abstract:

An indigenous, improved and cost effective process for the preparation of fungicide, Mancozeb, a complex compound of zinc with manganese ethylene bis dithiocarbamate in good yield (80 %) and purity (a.i. content 85 %) is developed by reacting aqueous solutions of Nabam (Disodium ethylene bis dithiocarbamate) with manganese and zinc salts. The intermediate, Nabam (a.i. 90%) is prepared in aqueous solution by reacting carbon disulphide, ethylene diamine and sodium hydroxide.



PATENTED

25. Improved Process For The Preparation of Mancozeb Seed-Cum-Fertilizer Grain Drilling Machine

Patent Number	231054
Date Of Certificate Issue	25/03/2009
Post Grant Journal Date	27/03/2009
Publication Number	30/2008
Publication Date	25/07/2008
Publication Type	INA
Application Number	851/DEL/2002
Application Filing Date	20/08/2002
Field Of Invention	MECHANICAL ENGINEERING
Classification (IPC)	A01C 7/20
Inventor	DR. BIJAN KUMAR DUTT

Abstract:

Pusa seed cum fertilizer disc drill includes a novel planting machinery and it is a tractor drawn mounted equipment utilizing a single or double disc opener assemblies and a torsion spring joints for connection of the disc assembly to the frame. Disc assemblies are arranged alternately and spaced laterally from each other in two transverse rows supported for rotation about a horizontal axis offset at a acute angle from transverse direction for opening a furrow. Fertilizer and seed boot assemblies are located adjacent the rearward facing convex side of the disc and includes a toe and tee scrapers. The users may adjust the relative position of disc opener with respect to transport wheels by simply manipulating a lever. Fertilizers and seed are dropped into the open trench by fertilizer and seed distributing means operated by two transport wheels via pulleys, V- belts and over running clutches. The clutches compensates for wheel slippage. Fertilizer and seed distributing means can be any proprietary items. The drill unit can include one or more pivotable open center bevelled edge press wheels which can be mounted for pivotal movement about the rear frame and which can be laterally spaced for proper placement of soil into covering relation to the fertilizer and seed. Adjustable down pressure spring extending between press wheels hub and vertical frame allow the press wheel to maintain ground contact and down pressure even when opener blades encounter an obstacle thus improving germination of the seed. The torsion spring assemblies that are prone to develop permanent deflection if seed drill is stored for a period of time. Parking stand are provided to prevent such deformation.





PATENTED

26. Biopesticidal Formulation With Improved Shelf Life And The Process Of Preparation

Patent Number	234480
Date Of Certificate Issue	15/06/2009
Post Grant Journal Date	26/06/2009
Publication Number	33/2007
Publication Date	17/08/2007
Publication Type	INA
Application Number	405/DEL/2006
Application Filing Date	14/02/2006
Field Of Invention	MICRO BIOLOGY
Classification (IPC)	A01N 63/00
Inventor	DR. PREM DUREJA, DR. BALRAJ SINGH PARMAR

Abstract:

A process for preparation of ready to use solid biopesticidal formulations with improved shelf life based on the biocontrol agent(s) such as the antagonist mycoparasite(s) ex. Trichoderma species and the biopesticidal product obtained thereof are reported. The dried and powdered solid hyphae of the agent are blended directly with an inorganic or organic inert carrier with or without the addition of other formulants to obtain a ready to use product complying the application requirements for use in pest control. It passed the accelerated storage test ($54 \pm 1^\circ\text{C}$, FAO 1999) prescribed for assessing the shelf life of two years of the chemical pesticides.



PATENTED

27. Synthetic Gene Encoding A Chimeric Delta-Endotoxin Of Bacillus Thuringiensis

Patent Number	237912
Date Of Certificate Issue	14/01/2010
Post Grant Journal Date	22/01/2010
Publication Number	14/2008
Publication Date	04/04/2008
Publication Type	INA
Application Number	2048/DEL/2006
Application Filing Date	18/09/2006
Field Of Invention	BIOTECHNOLOGY
Classification (IPC)	C12N15/09
Inventor	POLUMETLA ANANDA KUMAR

Abstract:

The present invention provides a means for plant protection against damage by a broad spectrum of insect pests. The invention comprises a chemically synthesized gene encoding a unique chimeric insecticidal protein (δ -endotoxin) of *Bacillus thuringiensis*. The chimeric δ -endotoxin comprises of Domain I of CryIAaI, Domain II of CryIAbI and part of Domain III of CryIAcI and a part of Domain III of CryIFaI. The unique chimeric protein is 624 amino acids in length. A synthetic gene was constructed based on DNA sequences of the native Bt structural genes (cryIAaI, cryIAbI, cryIAcI and cryIFaI). The sequences were modified in order to contain codons preferred by plant genes, to attain an A+T content in nucleotide base composition found in plants, and to eliminate sequences that cause destabilization, polyadenylation, degradation and termination of RNA and to avoid sequences that constitute RNA splice sites. In the synthetic gene codons used to specify a given amino acid were selected with regard to the distribution frequency of codon usage employed by plant genes to specify that amino acid. In addition, consideration was given to the percentage G+C content of the degenerate third base. The Bt gene designed for enhanced expression in plants was synthesized in fragments and assembled within a DNA plasmid vector. The synthetic Bt gene was then introduced into a tobacco plant and expressed. The chimeric insecticidal protein produced upon expression of the synthetic Bt gene in tobacco plants exhibited toxicity to Cotton bollworm and Tobacco caterpillar.





PATENTED

28. Additives For Improved Photostability Of Azadirachtin-At

Patent Number	227536
Date Of Certificate Issue	26/03/2010
Post Grant Journal Date	27/03/2009
Publication Number	25/2008
Publication Date	20/06/2008
Publication Type	INA
Application Number	460/DEL/2001
Application Filing Date	04/04/2001
Field Of Invention	AGROCHEMICALS
Classification (IPC)	A01N 65/00
Inventor	SAPNA JOHNSON, PREM DUREJA, SWARAN DHINGRA

Abstract:

The effectiveness, persistence and scope of use of many pesticides are limited or restricted by their stability, particularly to sunlight. The present invention relates to a process for preparation of photostable technical azadirachtin-A concentrate (a neem based pesticide), for use in the pest control of Spodoptera litura in the field by use of an effective amount of toxicologically safe additives to photolabile technical azadirachtin-A concentrate.



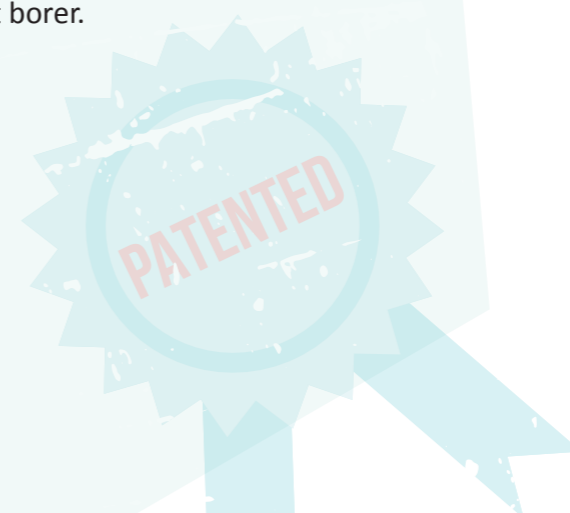
PATENTED

29. Synthetic Gene Encoding Cry1fa1 Delta - Endotoxin Of Bacillus Thuringiensis

Patent Number	242768
Date Of Certificate Issue	09/09/2010
Post Grant Journal Date	17/09/2010
Publication Number	14/2008
Publication Date	04/04/2008
Publication Type	INA
Application Number	2049/DEL/2006
Application Filing Date	18/09/2006
Field Of Invention	BIOTECHNOLOGY
Classification (IPC)	C12N15/09
Inventor	POLUMETLA ANANDA KUMAR

Abstract:

The present invention provides a means for plant protection against aarrage to crops, especially to tobacco and brinjal by insect pests, especially Spodopteralitura and Leucinodesorbonalis. The invention comprises a chemically synthesized gene encoding an insecticidal protein namely Cry IFal (endotoxin). The CrylFal 5-endotoxin protein is 616 amino acids in length. A synthetic gene was constructed based on DNA sequences of the native Bt structural genes (crylFal). The sequences were modified in order to contain codons preferred by plant genes, to attain an A+T content in nucleotide base composition found in plants, and to eliminate sequences that cause destabilization, polyadenylation, degradation and termination of RNA and to avoid sequences that constitute RNA splice sites. In the synthetic gene codons used to specify a given amino acid were selected with regard to the distribution frequency of codon usage employed by plant genes to specify that amino acid. In addition, consideration was given to the percentage G+C content of the degenerate third base. The Bt gene designed for enhanced expression in plants was synthesized in fragments and assembled within a DNA plasmid vector. The synthetic Bt gene was then introduced into tobacco and brinjal plants and expressed. The CrylFal insecticidal protein produced upon expression of the synthetic Bt gene in tobacco and brinjal plants exhibited toxicity to Tobacco caterpillar and Brinjal Shoot and Fruit borer.





PATENTED

30. Pusa Fruit Coring Device (Hand Operated)

Patent Number	243803
Date Of Certificate Issue	08/11/2010
Post Grant Journal Date	12/11/2010
Publication Number	04/2009
Publication Date	23/01/2009
Publication Type	INA
Application Number	465/DEL/2000
Application Filing Date	27/04/2000
Field Of Invention	GENERAL ENGINEERING
Classification (IPC)	A23N 4/00
Inventor	DR. HARI SHANKER SHARMA, DR. AMAR SINGH

Abstract:

A pusa coring device (hand operated) for removing cores from apple and pineapple comprising a frame vertically mounted in a base plate, a handle mounted on the frame, fruit holder mounted on base plate, coring tool fitted at the bottom of core conveyor, a core conveyor mounted on the top of coring tool, base plate mounted on the stand and stand.



PATENTED

31. Polymeric Seed Coats Based On Bioactive Botanicals

Patent Number	244542
Date Of Certificate Issue	10/12/2010
Post Grant Journal Date	17/12/2010
Publication Number	07/2008
Publication Date	15/02/2008
Publication Type	INA
Application Number	1746/DEL/2006
Application Filing Date	31/07/2006
Field Of Invention	BIO-CHEMISTRY
Classification (IPC)	A01C1/06
Inventor	DR. JITENDRA KUMAR, MR. NISAR KEYATH, DR. SURESH WALIA, DR. BALRAJ SINGH PARMAR, DR. ARUN KUMAR MADURAI BASAPPA

Abstract:

A process is described for the preparation of polymeric seed coats with or without the bioactive botanicals in their crude or pure form as exemplified by neem derivatives such as leaves, seeds, kernels as such, their extracts or the like or the bioactive ingredients eg.meliacins such as azadirachtin-A and their derivatives, salannin, nimbin, epi-nimbin and the like or the non meliacins bioactive principles contained in neem. It is characterized by the preparation of seed coats employing synthetic and or natural polymers; anionic or non ionic or their combinations surfactants and polar and non polar solvents as such or in combination with one another. The seed coats are characterized as powder soluble or suspended in water or organic solvents, flowable slurry or the like. Seed coats of the present invention find application in improving germination, viability, plantability /or vigour of an agronomic plant that is grown from a seed that is planted in a location having a level of infestation by fungal / nematode/insect or any other pest infestation that is a pest for the agronomic plant and against which a bioactive compound has activity. These products are also useful in improving the storability of the seed by checking the pest infestation and enhancing the overall seed quality during storage. Additionally such products are safe to handle. These are an invaluable input in organic agriculture.





PATENTED

32. Novel Superabsorbent Hydrogel/S And The Method Of Obtaining The Same

Patent Number	250349
Date Of Certificate Issue	28/12/2011
Post Grant Journal Date	30/12/2011
Publication Number	36/2008
Publication Date	05/09/2008
Publication Type	INA
Application Number	3462/DEL/2005
Application Filing Date	23/12/2005
Field Of Invention	PHARMACEUTICALS
Classification (IPC)	A61L 15/60
Inventor	DR.RAJESH KUMAR, DR. (MRS.)ANUPAMA, DR.BALRAJ SINGH PARMAR

Abstract:

Novel superabsorbent cellulosic hydrogels obtained by a method which comprises simultaneous grafting and chemical crosslinking of ethylenically unsaturated monomers onto cellulose ether backbones in the presence of free radical initiator of chemical or non-chemical origin in a homogeneous phase in polar solvent/s at a temperature of 15-100° C, reaction time from instantaneous to 24 hours to achieve the gel point, and an inert or ambient environment. Ethylenically unsaturated monomers herein include acrylic monomers preferably containing carboxamide groups and the like; the cellulose ether backbone comprising any of the carboxyalkyl cellulose, hydroxyalkyl cellulose or the like; the chemical initiator such as water soluble persulfates of ammonium, potassium, sodium or other alkali metals, ammonium ceric nitrate, peroxides such as hydrogen peroxide or organic peroxides, water soluble azo compounds such as 2,2'-azobis-(2-amidinopropane) and the like, used either alone or in combination with co-initiator; the non-chemical initiator such as electromagnetic radiations; the chemical crosslinking being carried out in the presence of a bisacrylamide. The hydrogels obtained herein possess water absorption potential of at least 15000% on mass-by-mass basis, while retaining structure and fluid absorption properties at temperatures upto 90° C.

PATENTED



PATENTED

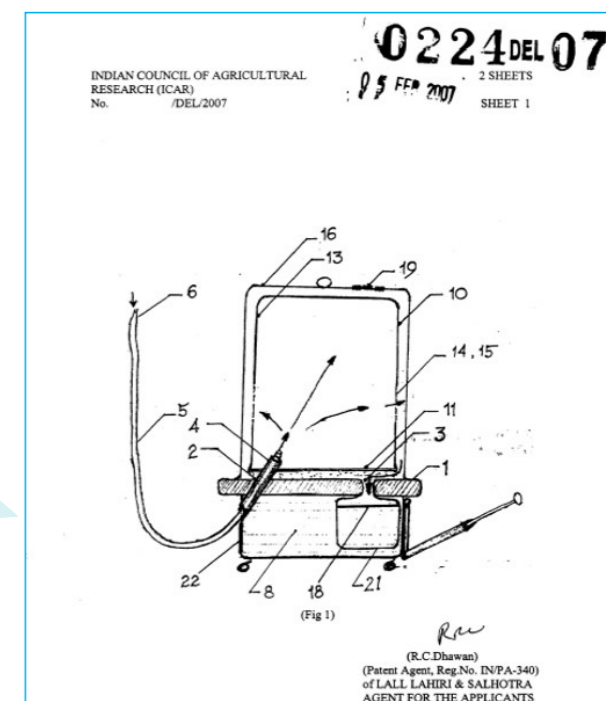
33. An Insect Handling Device

Patent Number	252363
Date Of Certificate Issue	10/05/2012
Post Grant Journal Date	11/05/2012
Publication Number	13/2007
Publication Date	30/03/2007
Publication Type	INA
Application Number	0224/DEL/2007
Application Filing Date	05/02/2007
Field Of Invention	MECHANICAL ENGINEERING
Classification (IPC)	A01M1/20
Inventor	KUMAR, PRADYUMN; SEKHAR, JAVAJI CHANDRA

Abstract:

An insect handling device comprises of a rigid platform provided with at least two holes, the first of the at least two holes being fitted with a guiding means, said guiding means is projected up the platform, plurality of ridges or protrusions are provided on top of platform or exterior of the lid of inner container for maintaining gap there between to enable flow air and the insect dust or scales to be collected, the at least second hole of said at least two holes is connected in an air tight manner with a vacuum generating means, an insect collecting inner container being placed over the said platform, a hole either in a lid or in a wall of the said inner container accommodates the projected end of the guiding means, the said wall and the lid of the inner container having perforations, the size of perforations being smaller than that of the insect being collected, an outer container with open bottom and closed from the top made from a material able to withstand vacuum and impermeable to air being fitted in an air tight manner on to the platform, an insect collecting tube, one end of said insect collecting tube being fitted with a nozzle for collecting insects and the other end being passed through the guiding means slightly projecting out the said guiding means and inside of the inner container.

PATENTED





PATENTED

34. Novel Superabsorbents And The Method (S) Of Obtaining The Same

Patent Number	274643
Date Of Certificate Issue	26/08/2016
Post Grant Journal Date	5/08/2016
Publication Number	09/2012
Publication Date	02/03/2012
Publication Type	INA
Application Number	1292/DEL/2010
Application Filing Date	2/6/2010
Field Of Invention	BIOTECHNOLOGY
Classification (IPC)	A01J
Inventor	ANUPAMA, SARKAR DHRUBA JYOTI, PARMAR BALRAJ SINGH

Abstract:

This invention relates to novel non-composite and composite superabsorbents, wherein the dry superabsorbents are xerogels, more particularly the bio-xerogels or the composites, particularly the biocomposites, more particularly the bionanocomposites and the method(s) of obtaining the same characterized by simultaneous in situ grafting and cross linking of ethylinically unsaturated monomers on to a single biopolymer of plant or animal origin, or on combination of different biopolymers or biopolymer(s) or / and clay(s), in a homogeneous polar phase, in the presence of initiator and crosslinker of chemical or non-chemical origin, at a temperature of 40 to 90 C, achieved by conventional or microwave heating, reaction time varying from instantaneous to 48 hours, involving use of alkali, either in situ or post reaction at room or elevated temperatures for achieving superior absorbency, in an inert or ambient reaction environment, to yield a neutral or near neutral product.



PATENTED

35. Samfungin: A Novel Fungicide And The Process For Making The Same

Patent Number	277235
Date Of Certificate Issue	16/11/2016
Post Grant Journal Date	18/11/2016
Publication Number	50/2012
Publication Date	14/12/2012
Publication Type	INA
Application Number	1599/DEL/2011
Application Filing Date	07/06/2011
Field Of Invention	PHARMACEUTICALS
Classification (IPC)	H02P
Inventor	GHOSE MANORANJAN, GOPAL MADHUBAN, ROY CHOUDHURY SAMRAT, DASGUPTA RATAN, DEVAKUMAR CHAKRAVARTHI, SUBRAHMANYAMBHATTIPROLU, SRIVASTAVA CHITRA, GOGOI ROBIN, KUMAR RAJESH, GOSWAMI ARUNAVA

Abstract:

Surface modified monoclinic sulfur nanoparticles of average size 20-100, their liquid synthesis using polyethylene glycol-400 as a surfactant and use as fungicide.





PATENTED

36. Invention Process For The Preparation Of 5-Substituted-1,3,4-Oxadiazole-2-Thiols As New Urease And Nitrification Inhibitors

Patent Number	279536
Date Of Certificate Issue	27/01/2017
Post Grant Journal Date	27/01/2017
Publication Number	36/2008
Publication Date	05/09/2008
Publication Type	INA
Application Number	3461/DEL/2005
Application Filing Date	23/12/2005
Field Of Invention	CHEMICAL
Classification (IPC)	A01N 43/76
Inventor	RAJESH KUMAR, ANUPAMA, BALRAJ SINGH PARMAR

Abstract:

5-Substituted-1,3,4-oxadiazole-2-thiols of formula, 1, as urease and nitrification inhibitors and an environment benign process for the preparation of the same by reacting carboxylic acid hydrazide, RCONHNH₂, with carbon disulphide, CS₂, in an energy transfer medium under microwave irradiation (MW1); wherein R is C₁ to C₆ saturated or unsaturated alkyl, unsubstituted or substituted by halogen, nitro, OR' - R' = CH₃, C₂H₅ and or hydroxy; CG to C₆₀ aralkyl or aryl, unsubstituted or substituted by C₁ to C₄ alkyl, halogen, nitro, OR' - R' = CH₃, C₂H₅ and or hydroxy; heterocyclyl, heterocycloalkyl and the like, are described. Following simple laboratory conditions, near quantitative yields of the resultant derivatives have been reported. Methods of the using the materials along with the various nitrogenous fertilizers are described.



PATENTED

37. Improvement In/Or Relating To Synthesis Of O- Alkyl Derivatives Of Oxime Ethers Of Piperonal As Potential Fungicides

Patent Number	281543
Date Of Certificate Issue	21/03/2017
Post Grant Journal Date	24/03/2017
Publication Number	30/2006
Publication Date	28/07/2006
Publication Type	INA
Application Number	1592/DEL/2004
Application Filing Date	25/08/2004
Field Of Invention	CHEMICAL
Classification (IPC)	C07D 213/44
Inventor	D.B. SAXENA, AARTI MAHAJAN

Abstract:

The present invention relates to the preparation O- alkyl oxime ether derivatives of piperonal wherein piperonal oxime reacts with alkyl halides in presence of a base in an organic solvent with continuous refluxing at 30 - 50°C to produce alkylated products. It also involves various solid and liquid preparations obtained by incorporating O-alkyl oxime ether derivatives of piperonal either alone or in combination with one or more suitable carriers, adjuvant and/or diluents for use in preventing or at least inhibiting the growth of fungi.





PATENTED

38. Pusa Chickpea Thresher

Patent Number	282047
Date Of Certificate Issue	30/03/2017
Post Grant Journal Date	07/04/2017
Publication Number	12/2010
Publication Date	19/03/2010
Publication Type	INA
Application Number	1121/DEL/2008
Application Filing Date	05/05/2008
Field Of Invention	AGROCHEMICALS
Classification (IPC)	A23L 1/00
Inventor	SINHA SACHCHIDA NAND, SINHA, JAGNNATH PRASAD, DHALIWAL, INDERJIT SINGH, AHUJA, SEWAK SINGH

Abstract:

Leguminous crops are very sensitive to mechanical abuses. Furthermore, chickpea is more prone for mechanical damage due to its germ tip located at protruding structure and are dicotyledonous. Even minor injury to seed affects seed quality adversely. Hence, a conventional cylinder and concave cannot be used to thresh chickpea seed crop. In general, pulse production and productivity is low world over and more so in developing countries (Jeswani and Baldev, 1990). One of the important reasons for low pulse productivity is non-availability of quality seed. The availability of quality seed, of chickpea is least i.e. about 2 per cent, among all the major crops of the country. However, it had been reported that about 20- 30 per cent average increase in productivity could be achieved with the use of quality seed (Chowdhary, 2004). Varying operational parameters such as cylinder speed, cylinder-concave clearance, fan speed helped to limited range in threshing but with induced significant amount of visible damages. In light of above facts, the new thresher was developed to thresh chickpea of high seed quality attributes i.e. maximum germination percentage; vigour and viability and minimal visible as well as invisible injuries. These quality attributes are dependent on operational parameters and design parameters of thresher. The optimum operational parameters of cylinder speed, beater type, feed rate, moisture content and concave clearance was 8.94 m/s, Teflon or nylon beater, 200 kg/h, 10 per cent and 14 mm, respectively. The specially configured threshing cylinder using Teflon beater/ threshing element produced seed of germination capacity (98), vigour (1800) and viability (98) coupled with minimal visible breakage (1.17) and internal injury (0.03) with optimum threshing efficiency (98).



PATENTED

39. Improved Neem Larvicidal Compositions

Patent Number	282129
Date Of Certificate Issue	31/03/2017
Post Grant Journal Date	07/04/2017
Publication Number	05/2012
Publication Date	03/02/2012
Publication Type	INA
Application Number	481/DEL/2006
Application Filing Date	22/04/2006
Field Of Invention	CHEMICAL
Classification (IPC)	A01N 65/00
Inventor	BALRAJ SINGH PARMAR, JITENDRA KUMAR, SWARAN DHINGRA

Abstract:

This invention relates to an improved neem larvicidal composition for use as such in the solution or emulsifiable concentrate or a derivative having slow release properties comprising of composition having an active constituent selected from neem pesticide alongwith thymol or p-cymene singularly or in combination along with the requisite auxiliaries. The active ingredients have been found to synergistically affect the control of the larvae of Culex fatigans.



PATENTED

40. A Slow Or Controlled Release Mosquito Larvicidal Composition And A Process For Preparation Thereof

Patent Number	282133
Date Of Certificate Issue	31/03/2017
Post Grant Journal Date	07/04/2017
Publication Number	05/2012
Publication Date	03/02/2012
Publication Type	INA
Application Number	482/DEL/2006
Application Filing Date	22/04/2006
Field Of Invention	CHEMICAL
Classification (IPC)	A61K 36/185
Inventor	BALRAJ SINGH PARMAR, RAM DAS GOPINATH

Abstract:

This invention relates to a slow or controlled release mosquito larvicidal composition comprising a composition having an active constituent selected from thymol, p-cymene present singularly or in combination or contained in an essential oil obtained from *Rabdosiamellissoides Benth*, said active ingredient present with or without a suitable surfactant and solvent, characterized in that said composition is encapsulated in a polymeric matrix. A slow or controlled release pesticidal composition is obtained through a monolithic dispersion of active ingredient in the matrix of polymers exemplified by polystyrene, polyvinyl chloride, thermocole, ethyl acetate and the like. A single application of the product enables an effective control of the pests, more particularly the water bone pests such as mosquitoes over an extended period of time.



PATENTED

41. Urea Molasses Mineral Block Machine

Patent Number	283378
Date Of Certificate Issue	18/05/2017
Post Grant Journal Date	19/05/2017
Publication Number	34
Publication Date	25/08/2006
Publication Type	INA
Application Number	1988/DEL/2004
Application Filing Date	12/10/2004
Field Of Invention	MECHANICAL ENGINEERING
Classification (IPC)	A23K 1/02
Inventor	AMAR SINGH, BRIJESH CHANDRA SRIVASTAVA, SUNIL KUMAR JHA, ADARSH KUMAR

Abstract:

India's Livestock sector has a significant impact on growth of country's economy. But there is a progressive shrinkage in grazing area with increasing human population, which has led to a growing concern for animal feeding. There has been increasing dependence on nutritionally poor feed like crop residues, which deteriorates the animal health and production drastically. To fulfil the nutritional requirements, supplements containing non-protein nitrogen (NPN) compounds with easily available carbohydrates could be given to the animals. Urea is one of the easily available and cheap source of NPN and molasses is a source of easily fermentable carbohydrate available in plenty. Laboratory studies have clearly indicated that feeding UMMB reasonably compensates the deficiency of low quality fibrous straws and provides nutrients for maintenance and production. But the existing manual process of UMMB preparation is time consuming, drudgerous and costly. Keeping above in view an Urea Molasses Mineral Block Machine has been developed. Drawing of the machine has been presented in Fig. 1 and front and side views of the machine have been presented in Plates 1.





PATENTED

42. A Novel Bio-Pesticidal Formulation With Improved Shelf-Life And The Method For Its Preparation

Patent Number	284264
Date Of Certificate Issue	31/07/2017
Post Grant Journal Date	23/06/2017
Publication Number	16/2008
Publication Date	18/04/2008
Publication Type	INA
Application Number	2218/DEL/2006
Application Filing Date	09/10/2006
Field Of Invention	BIOTECHNOLOGY
Classification (IPC)	A01N63/00
Inventor	SUDERSHAN GANGULY, ANUPAMA, BALRAJ SINGH PARMAR

Abstract:

A novel bio-pesticidal formulation based on an indigenous heat tolerant species of entomopathogenic nematode, *Steinernema thermophilum*, incorporated, immobilized and trapped into a water insoluble superabsorbent hydrogel matrix, has been developed for the first time by a simple method that comprises swelling of the xerogel in appropriate volume of aqueous suspension of the nematode. The formulation obtained has improved shelf life ranging from few hours to 36 months at storage temperatures varying from 5 to 50°C. The formulation is not infected by any microorganism, and hence does not require any anti-microbial or anti-fungal chemicals. It can be easily applied in the soil as well as in foliar spray without requiring any chemical reagent to facilitate the release of nematodes. The polymer used in its preparation offers additional water retention aid in the soil, or other plant growth media.



PATENTED

43. Development Of Slow Release Nano Formulations Of Bioactive Molecules And Method Of Preparation Thereof

Patent Number	290155
Date Of Certificate Issue	30/11/2017
Post Grant Journal Date	08/12/2017
Publication Number	06/2017
Publication Date	10/02/2017
Publication Type	INA
Application Number	257/DEL/2012
Application Filing Date	31/01/2012
Field Of Invention	CHEMICAL
Classification (IPC)	C07D 1/00
Inventor	SHAKIL N.A., KUMAR JITENDRA, SINGH M.K., LOHA KUMELACHEW MULU, ADAK TOTAN, KAUSHIK PRASHANT, ROY CHOWDHURY ARNAB, SARKAR DHRUBA JYOTI, PANKAJ

Abstract:

Slow release nano formulations of different bioactive molecules and a method of obtaining the same are described. The formulations are based on amphiphilic polymers utilizing poly(ethylene glycols) of different molecular weights as hydrophilic segment and various linker molecules such as aromatic digesters and their derivatives, aromatic diacids, aliphatic diacids or their derivatives. The release of bioactive molecules from these nano formulations is also described. The bioactive molecules, both synthetic and natural, more particularly as β -cyfluthrin, imidacloprid, thiram, thiomethoxam, carbofuran, pendimethalin, butachlor, sulfosulfuron, and azadirachtin and the likes. The preparation of formulations does not require any carrier or surfactant or binder to yield powder, slurry or the likes. These provide situation specific active ingredient release.





PATENTED

44. Anti-Oxidant And Anti-Bacterial Di-Aryl-Indazol-3-Ols And Their Method Of Preparation Thereof

Patent Number	290085
Date Of Certificate Issue	29/11/2017
Post Grant Journal Date	01/12/2017
Publication Number	03/2016
Publication Date	15/01/2016
Publication Type	INA
Application Number	3745/DEL/2012
Application Filing Date	06/12/2012
Field Of Invention	BIOTECHNOLOGY
Classification (IPC)	C12N
Inventor	SHAKIL N.A., KUMAR JITENDRA, SINGH M.K.

Abstract:

Microwave assisted synthesis of di-aryl-indazol-3-o1 derivatives are described. The synthetic methodology is based upon the approach of "green chemistry" which under solvent less condition utilizes the microwave irradiation as a source of energy for activation. Antioxidant activity and anti-bacterial activity of di-aryl-indazol-3-o1 derivatives is also described.



PATENTED

45. A Product And Process For The Decontamination Of Pesticide Residues From Vegetables By Using Safe Reagent

Patent Number	290363
Date Of Certificate Issue	07/12/2017
Post Grant Journal Date	08/12/2017
Publication Number	28/2015
Publication Date	10/07/2015
Publication Type	INA
Application Number	258/DEL/2012
Application Filing Date	31/01/2012
Field Of Invention	CHEMICAL
Classification (IPC)	C07C
Inventor	GOPAL MADHUBAN, RAJESH KUMAR, RAM NIWAS

Abstract:

The invention relates to the decontamination of pesticide residues from vegetables and removal pesticide from vegetable by treatment with a combination of inorganic/ organic reagents in/ under specified condition. The detoxified pesticide, unreacted / remaining organic product and residual reagents could be removed by washing with water. The process could successfully remove the pesticide residue from vegetable and do not leave any other toxic substance above safe limit even in washed water.





PATENTED

46. Light, Heat And Water Resistant Neem Meliacin Concentrates And Products With Controlled Release

Patent Number	291334
Date Of Certificate Issue	02/01/2018
Post Grant Journal Date	05/01/2018
Publication Number	33/2006
Publication Date	18/08/2006
Publication Type	INA
Application Number	2150/DEL/2004
Application Filing Date	29/10/2004
Field Of Invention	BIO-CHEMISTRY
Classification (IPC)	A61K 31/47
Inventor	BALRAJ SINGH PARMAR, CHANDERSHEKHAR REDDY, SURESH WALIA, JITENDRA KUMAR

Abstract:

A process of making meliacin concentrates and products stable to the abiotic and biotic environmental stress coupled with slow meliacin release is described. It comprises of homogenous incorporation of the meliacins(s) in a hydrophilic or hydrophobic polymeric matrices of natural, semi-synthetic or synthetic origin with or without the addition of other formulants. It results in the preparation of a wide range of monolithically dispersed, encased, encapsulated or coated product(s) with varied concentration and content of meliacins. The resultant light, heat and water resistant concentrates as well as the products based on them can find wide application in pest control under diverse application situations.



PATENTED

47. Nanoencapsulated Hexaconazole: A Novel Fungicide And The Process For Making The Same

Patent Number	292080
Date Of Certificate Issue	24/01/2018
Post Grant Journal Date	26/01/2018
Publication Number	37/2013
Publication Date	13/09/2013
Publication Type	INA
Application Number	2051/DEL/2011
Application Filing Date	21/07/2011
Field Of Invention	CHEMICAL
Classification (IPC)	C07D
Inventor	GOPAL MADHUBAN, ROY CHOUDHURY SAMRAT, INDRANI ROY, SAHELI PRADHAN, SRIVASTAVA CHITRA, GOGOI ROBIN, KUMAR RAJESH, GOSWAMI ARUNAVA

Abstract:

A hydrophilic encapsulation complex consisting essentially of nanosized hexaconazole wrapped by a hydrophilic polymer, its process of making and fungitoxic efficacy against fungal pathogens.





PATENTED

48. Pusa 5Sd-A Bio-Formulation Of Trichoderma Harzianum (IARI P-4) For Seed Treatment

Patent Number	292555
Date Of Certificate Issue	05/02/2018
Post Grant Journal Date	09/02/2018
Publication Number	14/2010
Publication Date	02/04/2010
Publication Type	INA
Application Number	2032/DEL/2008
Application Filing Date	28/08/2008
Field Of Invention	AGRICULTURE ENGINEERING
Classification (IPC)	C12N 15/00
Inventor	DUBEY SUNIL CHANDRA

Abstract:

It is an object of this to develop bio-formulation of the potential isolate of Trichoderma harzianum (IARI P-4; MTCC No. 5371) suitable for seed treatment with longer shelf (viability) life. Another objective of this invention is to develop a bio-formulation from the above mentioned fungal antagonist suitable for the management of diseases of crop plants. In accordance with the present invention, a novel seed dressing bio-formulation "Pusa 5SD" has been developed from the potential isolate of Trichoderma harzianum for management of soil and seed borne diseases of crop plants. The formulation yielded 1.8×10^6 to 2.1×10^6 viable cfu/g after 25 months of storage at room temperature and found effective against wilt of chickpea and dry root rot of chickpea and mungbean. The formulation is also suitable for other species of Trichoderma.



PATENTED

49. A Novel Formulation Of The Plant Growth Promoting Rhizobacteria With Enhanced Shelf-Life And The Method Of Its Preparation

Patent Number	292524
Date Of Certificate Issue	02/02/2018
Post Grant Journal Date	09/02/2018
Publication Number	08/2011
Publication Date	25/02/2011
Publication Type	INA
Application Number	1710/DEL/2009
Application Filing Date	18/08/2009
Field Of Invention	BIOTECHNOLOGY
Classification (IPC)	C12N 1/20
Inventor	LATA, ANUPAMA, PARMAR BALRAJ SINGH

Abstract:

A novel, ecofriendly indigenous, easy to use bacterial inoculant formulation with enhanced shelf-life at otherwise unfavourable high temperatures characteristic of tropics, characterized by one or more strains, species or genera of plant growth promoting microorganisms immobilized and entrapped inside the matrix of a water insoluble superabsorbent hydrogel of semi-synthetic origin maintained at moisture content equivalent of an appropriate per cent of the water absorption capacity of the superabsorber, capable to withstand temperature in the range 0-50°C for an effective time period of 36 to 12 months respectively with 60-100% survival of the entrapped microbes even in the absence of any extraneous source of nutrients, providing favourable environment for the conversion of active cells of some stains to transform into cysts and for others to retain their viability as such, free from microbial attack induced degradation has been developed by a simple method of introduction of microbes into the carrier matrix under ambient conditions, with additional advantages of transparent medium for direct examination of microbial cells under microscope and retaining water in the medium to which it is applied. The formulation can be easily applied in the soil, soilless media, seed and the like without requiring any chemical reagent.





PATENTED

50. Improvements In Or Relating To The Preparation Of Liquid Pesticidal Concentrates Of Neem Meliacin(S)

Patent Number	293925
Date Of Certificate Issue	07/03/2018
Post Grant Journal Date	09/03/2018
Publication Number	34/2006
Publication Date	25/08/2006
Publication Type	INA
Application Number	2416/DEL/2004
Application Filing Date	02/12/2004
Field Of Invention	PHARMACEUTICALS
Classification (IPC)	A01N 65/00
Inventor	BALRAJ SINGH PARMAR, PREM KUMAR, SURESH WALIA, JITENDRA KUMAR

Abstract:

A process for the preparation of liquid pesticidal compositions of neem meliacins such as azadirachtin, reduced azadirachtin or other meliacin(s) is described. It is characterized by the preparation of solution concentrates employing organic solvents selected from aliphatic mono and dihydric alcohols, ketones, chlorinated hydrocarbons, ethers, esters or the like, as such or in combination with one another, or with another solvent or solvent blend comprising of mixture of paraffinic, olefinic, aromatic, and naphthenic, hydrocarbons, with a need based addition of an emulsifier. Concentrates without the emulsifier yield Soluble Concentrates (SL) characterized by the formation of a clear solution on dilution with water or organic solvents. Those containing emulsifier yield Emulsifiable Concentrate (EC) characterized by formation of emulsion on dilution with water. Such solution concentrates find application for use against agricultural, public health and veterinary pests.



PATENTED

51. Nanocopper - A Copper Based Formulation To Combat Bacterial Blight Of Pomegranate, Rice And Bean

Patent Number	294416
Date Of Certificate Issue	16/03/2018
Post Grant Journal Date	23/03/2018
Publication Number	36/2016
Publication Date	31/08/2016
Publication Type	INA
Application Number	420/DEL/2012
Application Filing Date	15/02/2012
Field Of Invention	TRADITIONAL KNOWLEDGE BIOTECHNOLOGY
Classification (IPC)	A61K
Inventor	JAIN RAKESH KUMAR, MANI CHANDER, SIPANI N.S., MONDAL KALYAN K

Abstract:

The present invention relates to an inexpensive, economical and reliable liquid formulation with very high efficacy to combat bacterial blight in pomegranate, beans and rice incited by *Xanthomonas axonopodispv. punicae*, *Xanthomonas campestris pv. phaseoli* and *Xanthomonas oryzaepv. oryzae*, respectively. This formulation does not need refrigeration for maintaining the viability of the bacteria and can be stored at room temperature without affecting its efficacy. The formulation can be easily applied on to the standing crops and does not require preparation of a sticker solution for its application. The product can be stored in air tight polypropylene bottles, occupies very less space and the product is easy to handle and transport across long distances. The present method is suitable for both small scale and large scale application.





PATENTED

52. Development Of Scar Marker For Identification Of Chaetomium Globosum - A Potential Biocontrol Agent

Patent Number	294901
Date Of Certificate Issue	26/03/2018
Post Grant Journal Date	30/03/2018
Publication Number	05/2012
Publication Date	03/02/2012
Publication Type	INA
Application Number	577/DEL/2009
Application Filing Date	25/03/2009
Field Of Invention	BIOTECHNOLOGY
Classification (IPC)	C12Q1/68
Inventor	AGGARWAL RASHMI, GUPTA SANGEETA, RENU

Abstract:

In this study we report the application of sequence-characterized amplified region (SCAR) marker for the detection of Chaetomium globosum. DNA was extracted from pure cultures of fifteen Chaetomium globosum isolates (Cg1-Cg15) and one isolates each of C. reflexum (Cr) and C. perlucidum (Cp). 12 URP primers were used for DNA amplification of all Chaetomium isolates mentioned as above. URP-2R produced a unique DNA band of 1.9 kb in all the isolates of C. globosum but not in C. reflexum and C. perlucidum. This band was eluted and ligated into pGEMT vector. Transformed colonies (White) were used for sequencing and four primer pairs were designed. PCR was performed using all the four synthesized Primers. Amplification with primer Cg 5P (forward primer) 5'-CAC CAA TCG CAC ACT TTG ACC-3' and Cg2 (2) (reverse primer) 5'-ACT GAT CGC ACA CTC CAC CTCT -3' produced a unique DNA band of 1.9 kb in all the isolates of Chaetomium globosum but it was absent in C.perlucidum, C.reflexum, C.cupreum, C. cochlioides as well as in other fungal genera Aspergillus flavus, Bipolaris sorokiniana and Fusarium moniliforme. Diagnostic PCR was performed using the primer pair IV. The results showed that this SCAR marker can clearly distinguish Chaetomium globosum at inter specific level as well as inter generic level. Our data provided the foundation for a precise and rapid PCR-based diagnostic system for Chaetomium globosum a biocontrol agent at its site of application.

PATENTED



PATENTED

53. Development Of Polymeric Formulations Of Bioactive Molecules And Method Of Preparation Thereof

Patent Number	295150
Date Of Certificate Issue	28/03/2018
Post Grant Journal Date	06/04/2018
Publication Number	03/2016
Publication Date	15/01/2016
Publication Type	INA
Application Number	3746/DEL/2012
Application Filing Date	06/12/2012
Field Of Invention	POLYMER TECHNOLOGY
Classification (IPC)	C08F
Inventor	KUMAR JITENDRA, SHAKIL N.A., ADAK TOTAN, SARKAR DHRUBA JYOTI, ROY CHOWDHURY ARNAB

Abstract:

The present technological innovation concentrates on the preparation of polymers based formulations of agrochemicals for seed quality enhancement and effective pest management by utilizing amphiphilic polymers and bioactive molecules. The formulations are prepared by monolithic dispersion or encapsulation techniques by utilizing, bioactive molecules, PEG based synthesized amphiphilic polymers and very low solvents or no solvent. The loading capacity and encapsulation efficiency of developed polymers is reported. To ascertain the tenacity properties, the release of bioactive molecules from these formulations in water, is also described. The bioactive molecules, both synthetic and natural, more particularly as imidacloprid, thiamethoxam, carbofuran, pendimethalin, sulfosulfuron, and azadirachtin and the likes are used. These formulations of different bioactive materials will release them in controlled manner thereby improving their bioefficacy upon the existing formulations. These formulations which provide improved tenacity and uniform coating of a.i therefore minimize the losses during processing / handling. The developed formulations increase the availability of bioactive materials for protection against various pests in diverse use situations. The bioactive molecule which has less water solubility, their solubility in water is improved by encapsulating them in amphiphilic polymers which facilitate their systemic action. The polymeric formulations of the present invention will help in protecting an agronomic plant for a longer duration owing to slow release of active molecules. The developed products may be used as spray and seed treatments for efficient management of the pests. Additionally, such products are safe to handle and cost effective.

PATENTED





PATENTED

54 Composition For Early, Profuse Sporulation Under Solid State, Of The Improvised Isolate Of Trichoderma Harzianum And A Process Thereof

Patent Number	296712
Date Of Certificate Issue	11/05/2018
Post Grant Journal Date	18/05/2018
Publication Number	36/2008
Publication Date	05/09/2008
Publication Type	INA
Application Number	3459/DEL/2005
Application Filing Date	23/12/2005
Field Of Invention	MICRO BIOLOGY
Classification (IPC)	C12N 1/14
Inventor	PRATIBHA SHARMA, PREM DUREJA, SATISH KUMAR SAIN, DHARAM VIR SINGH

Abstract:

The various kind of substrates are utilized for mass production and fast multiplication and to formulate bio formulations, employing few parameters essential for bioformulation development of Trichoderma which resulted in less growth and shorter shelf life of the active bioagents in the earlier developed media. Moreover such formulations do not have an effective and broad-spectrum use in crops with effective bioactivity. In the present invention process for solid based biomass production of biocontrol agent(s) employing mycelium, chlamyospores and conidia of the biocontrol agent directly along with an inert carrier and with or without the addition of other supplement(s) to increase stability, shelf life of biomass and further the viable product of the biocontrol agent. Additionally, a media with specific supplements capable of supporting energy needs of the selected broad-spectrum bioagent was employed. Thus this novel way of formulating biocontrol agents can provide products, which are shelf stable, broad spectrum, for multipathogen, crop and location and become viable under favorable use conditions. This product can be used against multipathogens, outcrops in any chemical or integrated management system of vegetables.



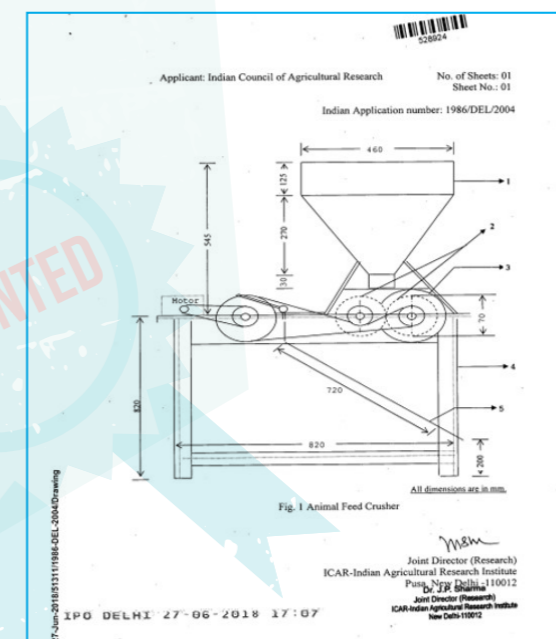
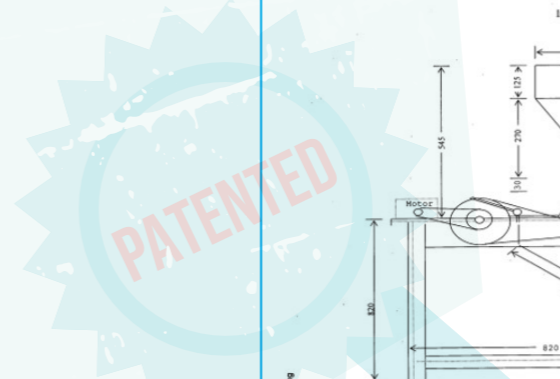
PATENTED

55. Animal Feed Crusher

Patent Number	299908
Date Of Certificate Issue	13/08/2018
Post Grant Journal Date	17/08/2018
Publication Number	30
Publication Date	28/07/2006
Publication Type	INA
Application Number	1986/DEL/2004
Application Filing Date	12/10/2004
Field Of Invention	MECHANICAL ENGINEERING
Classification (IPC)	A23N 17/00
Inventor	ER. AMAR SINGH, DR. SUNIL KUMAR JAHA, DR. JAIPAL SINGH PANWAR, DR. ADARSH KUMAR

Abstract:

The preference and acceptability of the compacted feed blocks by animals have been well recognized. Wide variety of crop materials is available in Indian agrarian scenario for compaction into feed blocks. The formation of crops based feed blocks requires unit operations of size reduction, drying, mixing and compaction. Drying of high moisture crops being energy intensive process has received worldwide attention. The effect of crushing on drying characteristics of forage crops namely, sorghum, barley and cluster beans were studied. Crushing of these samples was done to hasten the sun drying. It was found that crushed samples could be sun dried from an initial moisture content of about 200% (d.b.) to the 14-16% (d.b.) in 6 h. Keeping above in view an Animal Feed Crusher has been developed. Drawing of the machine has been presented in Fig. 1. Photograph of the machine has been presented in Plate 1.





PATENTED

56. Amphiphilic Polymers Based Slow Release Nano Formulations Of β -Carotene And Method Of Preparation Thereof

Patent Number	300102
Date Of Certificate Issue	20/08/2018
Post Grant Journal Date	24/08/2018
Publication Number	33/2014
Publication Date	15/08/2014
Publication Type	INA
Application Number	3744/DEL/2012
Application Filing Date	06/12/2012
Field Of Invention	POLYMER TECHNOLOGY
Classification (IPC)	C08F
Inventor	KUMAR JITENDRA, SHAKIL N.A., SINGH BRAJ BHUSHAN, WALIA SURESH

Abstract:

The present technological innovation concentrates on the preparation of Amphiphilic polymers based slow release nano formulations of β -carotene. The formulations are prepared by monolithic dispersion or encapsulation techniques by utilizing β -carotene, PEG based synthesized amphiphilic polymers and very little or no solvent. The loading capacity and encapsulation efficiency of developed polymers is reported. The formulations are based on both functionalized and non-functionalized amphiphilic polymers imparting surfactant and carrier properties to the formulation. Because of their universal solubility, formulation can directly be dissolved in water for application. The developed formulations increase the availability of β -carotene for absorption from aqueous solution. The release of β -carotene from these nano formulations is also described. The slow release nano formulations of the present invention will help in increasing the bioavailability of β -carotene for a longer duration owing to slow release of active molecules.



PATENTED

57. Fusion Gene Construct For Generation Of Cocktail Antiserum For Detection Of Potyvirus And Cucumovirus

Patent Number	299749
Date Of Certificate Issue	06/08/2018
Post Grant Journal Date	10/08/2018
Publication Number	36/2016
Publication Date	31/08/2016
Publication Type	INA
Application Number	419/DEL/2012
Application Filing Date	15/02/2012
Field Of Invention	BIOTECHNOLOGY
Classification (IPC)	C12N
Inventor	DR. MANDAL BIKASH, DR. JAIN K. R, MS. KAPOOR REETIKA, MR. PHANEENDRA C., MS. SWAPNA GEETANJALI

Abstract:

The present invention relates to the development of dual gene construct for generation of recombinant fusion protein in E. coli and generation of cocktail of polyclonal antibody that will help in simultaneous detection of Potyviruses (Papaya ringspot virus, PRSV) and Cucumoviruses (Cucumber mosaic virus, CMV). The methodology involves cloning of core coat protein genes of PRSV and CMV and preparation of expression construct by placing CMV and PRSV sequence in tandem orientation in pET 28a vector. Cocktail polyclonal antibody was generated against the expressed recombinant dual protein of the two viruses. The present invention provides cost and time effective method for simultaneous detection of multiple infection of plant viruses as this dual antiserum can be used for simultaneous detection of PRSV and CMV. This strategy would be very useful in detecting viruses in vegetatively propagating crops like Potato or Banana etc.





PATENTED

58. Beneficiation Of Phosphate Rock For The Segregation Of Phosphorus Containing Heavy Metal Free Minerals

Patent Number 301187
 Date Of Certificate Issue 19/09/2018
 Post Grant Journal Date 28/09/2018
 Publication Number 23/2016
 Publication Date 03/06/2016
 Publication Type INA

Application Number 1042/DEL/2014
 Application Filing Date 16/04/2014
 Field Of Invention CHEMICAL
 Classification (IPC) C01B 25/00
 Inventor DR. SIDDHARTHA SHANKAR MUKHOPADHYAY

Abstract:

The present invention relates to the novel method of separation of exclusive phosphorus-minerals from phosphate rock (PR) ore (sedimentary provenance) in order to obtain heavy-metal free advance phosphorus (P) based products, so that manufactured products and by-products are useful to industries engaged in phosphorus fertilizers and other phosphorus containing products, and products derived from raw materials like gypsum, dolomite, feldspars, apatites, and sepiolites or use them as such. The novel process is more than one sense superior to conventional beneficiation process.



PATENTED

59. Powered Animal Feed Mixer

Patent Number 302775
 Date Of Certificate Issue 31/10/2018
 Post Grant Journal Date 09/11/2018
 Publication Number 34
 Publication Date 25/08/2006
 Publication Type INA
 Application Number 1983/DEL/2004
 Application Filing Date 12/10/2004
 Field Of Invention MECHANICAL ENGINEERING
 Classification (IPC) A23M 17/00
 Inventor AMAR SINGH, SUNIL KUMAR JHA, JAIPAL SINGH PANWAR, ADARSH KUMAR

Abstract:

India's Livestock sector has a significant impact on growth of country's economy. But there is a progressive shrinkage in grazing area with increasing human population, which has led to a growing concern for animal feeding. There has been increasing dependence on crop residues and by products like straws, bran and cakes for animal feed. However, major constraints to the utilization of these crop residues are their low bulk density and poor nutritive value. Different treatments have been suggested for improving the nutritive value. But low bulk density has remained a concern as far as their transportation and storage is concerned. Animal nutrition experts have been suggesting on feeding residue based complete balanced feed block which would not only be useful nutritionally but would also solve the problem of transportation, storage and handling. Feed block formation requires uniform mixing and compression of feed ingredients. Keeping above in view a Powered Animal Feed Mixer has been developed which can uniformly mix the ingredients of different sizes and densities. Drawing of the machine has been presented in Figs 1 and 2. Photographs of the machine have been given in Plates 1 & 2.





PATENTED

60. Pigeonpea Pod Stripper

Patent Number	313550
Date Of Certificate Issue	31/05/2019
Post Grant Journal Date	07/06/2019
Publication Number	37/2013
Publication Date	13/09/2013
Publication Type	INA
Application Number	2053/DEL/2011
Application Filing Date	21/07/2011
Field Of Invention	MECHANICAL ENGINEERING
Classification (IPC)	A01D45/00
Inventor	DR. JAGNNATH PRASAD SINHA

Abstract:

The present stripper has been designed to mechanize pod separation of pigeonpea with high labour efficiency, timeliness in completion of operation and also economizing the operation. The separated pods can be efficiently threshed by pod thresher with minor adjustment in operational parameters. Combination of spike tooth type and wire loop type elements attains maximum stripping efficiency without damaging the seed and stalk. The optimum rotation speed for stripping cylinder is about 9.6 m/s. The material of spike tooth plays an important role in minimizing mechanical injury to seed during stripping. The nylon spikes embedded with tempered steel is found effective in reducing minor injury to seed as well as exhibited toughness towards bending or breakage of spikes. Overall, the stripper is able to reduce labour requirement by 80 % and reduction in cost of operation by 73 % with 7 percent point enhanced recovery.



PATENTED

61. Nanofabrication Of Phosphorus On Kaolin Mineral Receptacles

Patent Number	316692
Date Of Certificate Issue	24/07/2019
Post Grant Journal Date	26/07/2019
Publication Number	36/2016
Publication Date	31/08/2016
Publication Type	INA
Application Number	989/DEL/2014
Application Filing Date	07/04/2014
Field Of Invention	CHEMICAL
Classification (IPC)	C05G 3/00
Inventor	DR. SIDDHARTHA MUKHOPADHYAY

Abstract:

Nanofabrication of phosphorus on kaolin mineral receptacles refers to the fabrication of nanomaterial by intercalating phosphate ion (PO_4^{3-}) on kaolin clay mineral for its slow and consistent release in the soils when applied as fertilizer. It relates to the dissolution of phosphate ion in rhizospheric acid medium from phosphorous rich mineral species. Here, PO_4^{3-} was brought to solution phase from Pcontaining mineral fractions and transported to reaction chamber, where they were intercalated in the kaolin clay mineral moiety. P containing mineral fractions was free from heavy metals and other contaminants, and thereby final nanoprodut was free from those. It was hypothesized that when the final nanoprodut is applied to soil as fertilizer, it would release either of PO_4^{3-} , or get converted to hydrogen phosphate ion (HPO_4^{2-}) or dihydrogen phosphate ion ($H_2PO_4^-$), due to presence of water in soil. The final product was dried and stored in sterilized container.





PATENTED

62. Heat Stable Anthocyanin Rich Composition Andprocess Of Its Preparation

Patent Number	321722
Date Of Certificate Issue	27/09/2019
Post Grant Journal Date	04/10/2019
Publication Number	33/2014
Publication Date	15/08/2014
Publication Type	INA
Application Number	3130/DEL/2012
Application Filing Date	08/10/2012
Field Of Invention	CHEMICAL
Classification (IPC)	A23L 33/00, C07C
Inventor	DR. CHARANJIT KAUR, DR. SURESH WALIA, RAMKRISHNA PAL

Abstract:

The present invention relates to heat stable anthocyanin rich composition with high nutraceutical value. More particularly, the invention relates to a process of preparation of anthocyanin and phenolic enriched products from biological resources such as black carrot, plum, grapes and alike through a novel enzyme mediated process. The enzyme mediated A processing employs cell wall degrading enzymes to increase extraction efficiency. The process is green and solvent free, for effective extraction of the aqueous extract or juice rich in w nutraceutical content. The process is governed by variables such as upstream and downstream process steps with optimized variables of enzyme concentration, extraction time and temperature. The concentrate can be used as value added ingredients for developing a functional products such as beverages, functionalized juices and bakery products.



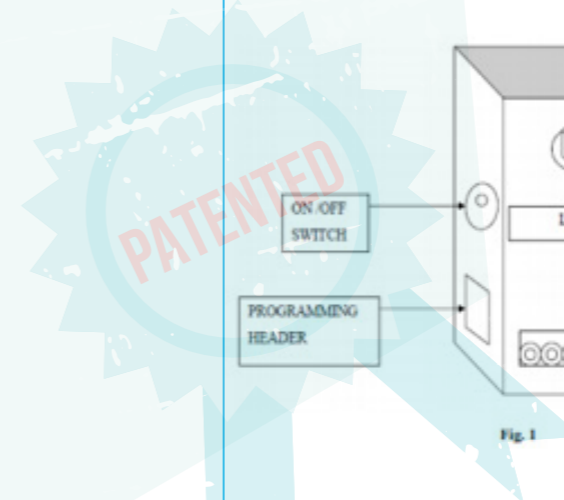
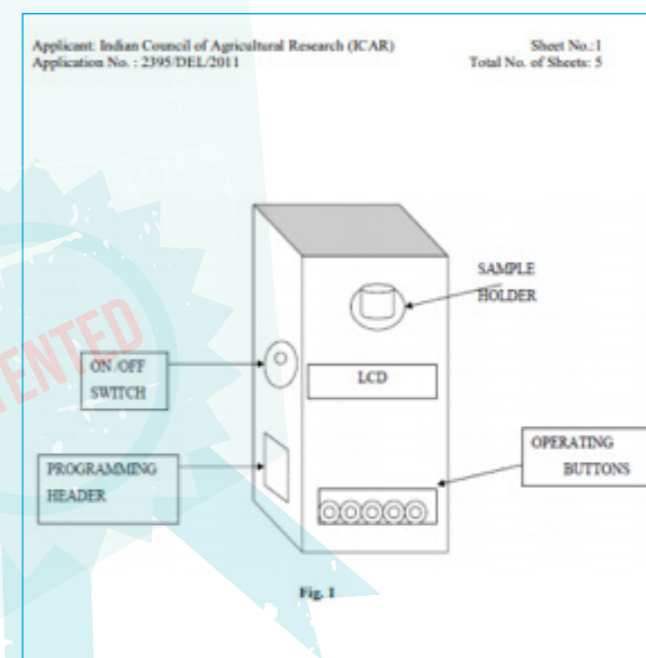
PATENTED

63. Digital Soil Test And Fertilizer Recommendation (Stfr) Meter

Patent Number	330282
Date Of Certificate Issue	27/01/2020
Post Grant Journal Date	31/01/2020
Publication Number	41/2013
Publication Date	11/10/2013
Publication Type	INA
Application Number	2395/DEL/2011
Application Filing Date	24/08/2011
Field Of Invention	ELECTRICAL
Classification (IPC)	H01B
Inventor	DR. DATTA SAMAR CHANDRA

Abstract:

The present invention relates to a low cost, user friendly digital embedded system instrument which can quantitatively estimate available nutrients in soil such as organic carbon, nitrate, phosphorus, potassium, sulphur, zinc and boron. The available nutrient in a soil is extracted with a reagent and a colour is developed in the extract with another reagent. The colour intensity which is proportional to the amount of nutrient extracted is measured by this STFR meter. The instrument has five press buttons. UP and DOWN button is used to browse the instrument and ENTER button is used to select the nutrient to be measured. ESC button is used to go to the previous menu. RESET button is used to go to the opening menu. After estimating all the nutrients, fertilizer recommendation can be obtained for a selected crop and the selected yield target from the FERTILIZER DOSE item of the menu.





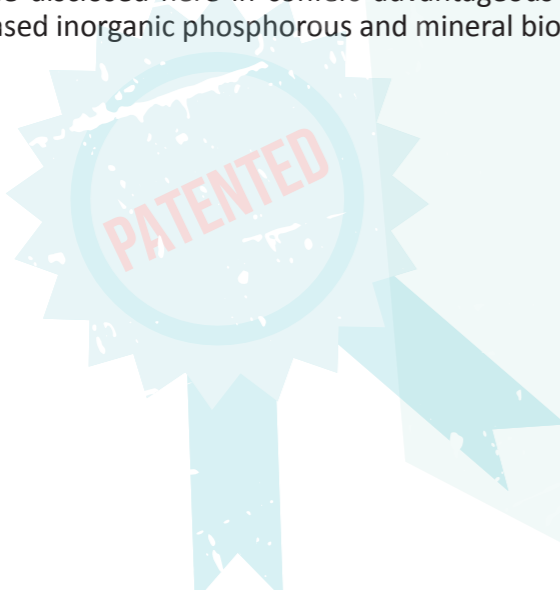
PATENTED

64. Plant Transformation Vector For Suppressing MIPS Gene Expression And Method For Culturing Low Phytate Soybean

Patent Number	341699
Date Of Certificate Issue	15/07/2020
Post Grant Journal Date	17/07/2020
Publication Number	06/2017
Publication Date	10/02/2017
Publication Type	INA
Application Number	2432/DEL/2015
Application Filing Date	07/08/2015
Field Of Invention	BIOTECHNOLOGY
Classification (IPC)	C12N 15/00
Inventor	DR.ARCHANA SACHDEV, MR.AWADHESH KUMAR, MR.ALKESH HADA, MRS.VEDA KRISHNAN, MRS.MONICA JOLLY, MRS. MANSI PUNJABI, MRS.NABNEETA BASAK, MS. VANITA PANDEY, MR.ASHISH MARATHE

Abstract:

Plant transformation vector for suppressing MIPS gene expression and method for culturing low phytate soybean provides a plant transformation vector and method for transforming soybean plants. The vector is design to suppress or enhance gene of interest in plants. The plant transformation vector comprises a plant active promoter, a terminator, a plant selection marker and a bacterial selection marker. The present invention also provides a method of transformation for reducing phytate in soybean comprises growing a soybean plant comprising MIPS"intron hairpin expression cassette operably linked to a promoter {vicilin) that drives tissue specific expression in plants. The expression of this novel RNAi hairpin cassette for silencing MIPS gene disclosed here in confers advantageous nutritional properties i.e. reduced phytate content with increased inorganic phosphorous and mineral bioavailability, and leads to valuable and useful soybean products.



PATENTED

65. Liquid Bioinoculant Of Azotobacter Chroococcum And The Process Thereof

Patent Number	338098
Date Of Certificate Issue	08/06/2020
Post Grant Journal Date	12/06/2020
Publication Number	48/2012
Publication Date	30/11/2012
Publication Type	INA
Application Number	518/DEL/2011
Application Filing Date	25/02/2011
Field Of Invention	AGROCHEMICALS
Classification (IPC)	A01N
Inventor	DR. SANGEETA PAUL, DR BISHWAJEET PAUL, MR. MAHESHWAR SINGH RATHI, DR. BRAHMA KAUSHIK

Abstract:

The present invention relates to inexpensive, economical and reliable method of production of liquid inoculant with very high population of A. chroococcum of more than 10¹² cfu/ml which has a prolonged shelf life of approximately 30 months. This formulation does not need refrigeration for maintaining the viability of the bacteria and can be stored at room temperature without affecting the viability of the bacteria. The formulation can be easily applied on the seed/seedling and does not require preparation of a sticker solution for its application, it also enhances seed germination, seedling vigor, plant growth and yield. The product can be stored in air tight polypropylene bottles, occupies very less space and there is no production of gas in these bottles. Thus, the product is easy to handle and transport across long distances. The present method is suitable for both small scale and large scale biofertilizer production unit.





PATENTED

66. Insecticidal Formulation Of Novel Strain Of Bacillus Thuringensis Ak 47.

Patent Number	340541
Date Of Certificate Issue	06/07/2020
Post Grant Journal Date	10/07/2020
Publication Number	09/2016
Publication Date	26/02/2016
Publication Type	INA
Application Number	2361/DEL/2014
Application Filing Date	20/08/2014
Field Of Invention	BIOTECHNOLOGY
Classification (IPC)	C12N15/09
Inventor	ANIL KUMAR SAXENA, JASDEEP CHATRATH PADARIA, GOVIND TIKARAMSA GUJAR, AJAR NATH YADAV, SHOWKAT AHMAD LONE, MONIKA TRIPATHI, MAHENDRA VIKRAM SINGH RAJAWAT

Abstract:

A formulation of novel strain of Bacillus thuringiensis having insecticidal activity was isolated following enrichment in sodium acetate buffer amended Luria broth medium from soil of Bhitarkanika mangrove, Orissa, India. The novel microbe was identified as Bacillus thuringiensis based on 16S rDNA amplification and deposited at IMTECH, Chandigarh (accession numbers: MTCC 5846). PCR analysis resulted in successful amplification of 9 cry and 7 other insecticidal genes. Based on amplification of the conserved domains, following genes were found to be present in the isolate: cry genes: cryI, 8, cryIAb, cryIAc, cryIC, cryIF, cryIG, cry2Aa, cry2Ab, cryIac, other insecticidal, fungicidal and bactericidal genes: vip2A, nheA, nheB, nheC, chit, chit36 and ZmaR. The strain was found to be effective against lepidopteran pests in bioassay studies. Hence it is a potential candidate to be employed as a biocontrol agents against insect pests. Moreover, by using this technology, farmers can save money on chemical pesticides.



PATENTED

67. A Cross Flow Flexible Membrane Filtration Assembly For Small Processing Volume

Patent Number	343546
Date Of Certificate Issue	06/08/2020
Post Grant Journal Date	14/08/2020
Publication Number	42/2013
Publication Date	18/10/2013
Publication Type	Ina
Application Number	3771/Del/2012
Application Filing Date	07/12/2012
Field Of Invention	Mechanical engineering
Classification (IPC)	B41d
Inventor	DR. GOPAL P. AGARWAL, MUTHUMAREESWARAN M. R, SATYENDRA SINGH

Abstract:

A cross-flow fluid filtration mountable membranes assembly for concentrating and separating the liquid stream at low processing volume sample, comprising of flexibility for spiral-wound membranes, Organic tubular and Ceramic tubular membrane and 10 means for controlling the pressure, velocity and volume of the liquid stream.





PATENTED

68. Pusa Basmati Rice Thresher

Patent Number	346124
Date Of Certificate Issue	04/09/2020
Post Grant Journal Date	11/09/2020
Publication Number	52/2014
Publication Date	26/02/2016
Publication Type	INA
Application Number	1802/DEL/2013
Application Filing Date	19/06/2013
Field Of Invention	AGRICULTURE ENGINEERING
Classification (IPC)	A01F 12/00
Inventor	JAGNNATH PRASAD SINHA, SUNIL KUMAR JHA, ANOOP KUMAR DIXIT, ROHINESH KHURANA, DAVID VIJAY KUMAR SAMUEL, GURSAHIB SINGH MANESH, SALWINDER SINGH ATWAL, ARVIND KUMAR GUPTA, RITESH SHARMA

Abstract:

The present invention relates to a machine for threshing of basmati rice or other cereals. More particularly, this invention relates to a threshing machine especially for Basmati Rice, in which a separation of kernels from plant parts occurs with least or no mechanical injury. It essentially consists of threshing cylinder, cleaning unit, feeding system and frame. It facilitates threshing of basmati crop with the least mechanical injury, either visible or invisible, for further seed multiplication or grain production. The present invention is compact and equipped with farm transportation wheels. It facilitates field level threshing operation, minimizes the problem of bulk handling and reduces losses in handling. It also comply safety norms of farm machines.



PATENTED

69. Novel Naphthyridine Based Hydrazines As Potent Agrochemicals

Patent Number	349105
Date Of Certificate Issue	13/10/2020
Post Grant Journal Date	16/10/2020
Publication Number	46/2012
Publication Date	18/10/2013
Publication Type	16/11/2012
Application Number	2964/DEL/2010
Application Filing Date	13/12/2010
Field Of Invention	CHEMICAL
Classification (IPC)	C07D
Inventor	DR. KUMAR RAJESH, MS. AGGARWAL NISHA, DR. CHITRA SRIVASTAVA, PROF. KHURANA JITENDER MOHAN, DR. DUREJA PREM

Abstract:

Naphthyridine based novel hydrazines of formula 1 as insect growth regulator, fungicide and nitrification inhibitors, and process of their synthesis. Wherein A is (C1-C20) alkyl (straight chain and substituted chain), hetero alkyl, alkyloxy, arylalkyloxy, aryl alkyl, optionally substituted aryl heteroaryl, optionally substituted heterocyclyl, unsaturated alkyl, aryl, unsaturated, substituted aryl. Aryl is phenyl, substituted phenyl (Halo, nitro, cyano, hydroxyl, amino, optionally substituted alkyl, alkyloxy, cycloalkyl, -COR, SO₂R). X is C, N, P, S Y is O and S R and R₁ is independently selected from hydrogen, halo, nitro, cyano, hydroxyl, amino, optionally substituted hydroxyalkyl, haloalkyl, aryl alkyl, optionally substituted heterocycles, alkylthio. Z is hydrogen atom, n-alkyl (C1-C10), optionally substituted (C4-C6) alkyl containing tertiary carbon. The present invention relates to the preparation of novel naphthyridine based hydrazines, their synthetic protocol and as well as the various solid and liquid preparations obtained by incorporating naphthyridine based novel hydrazines either alone or in combination with one or more suitable carriers, adjuvants and/or diluents for use as insect growth regulators, nitrification inhibitors and in preventing or at least inhibiting the growth of fungi.





PATENTED

70. Zinc In Clay-Mineral Receptacles In Nanoforms For Their Use As A Advance Materials Including Novel Fertilizer

Patent Number	354498
Date Of Certificate Issue	26/12/2020
Post Grant Journal Date	01/01/2021
Publication Number	03/2015
Publication Date	16/01/2015
Publication Type	INA
Application Number	2093/DEL/2013
Application Filing Date	19/06/2013
Field Of Invention	CHEMICAL
Classification (IPC)	C05G 3/00
Inventor	MANJOT SINGH, DR. SIDDHARTHA SHANKAR MUKHOPADHYAY, KR. KIRAN JEET DR. RAJDEEP KAUR, SHIKHA SHARMA

Abstract:

The present invention relates to a machine for threshing of basmati rice or other cereals. More particularly, this invention relates to a threshing machine especially for Basmati Rice, in which a separation of kernels from plant parts occurs with least or no mechanical injury. It essentially consists of threshing cylinder, cleaning unit, feeding system and frame. It facilitates threshing of basmati crop with the least mechanical injury, either visible or invisible, for further seed multiplication or grain production. The present invention is compact and equipped with farm transportation wheels. It facilitates field level threshing operation, minimizes the problem of bulk handling and reduces losses in handling. It also comply safety norms of farm machines.



PATENTED

CHAPTER-4

Afterword

As IPRs are the founding block for supporting the commercial success and thereby the growth of an enterprise or organisation, their value need to be recognition and appreciated. While the main task of the IP Cell of an organisation is to promote creativity and innovation; recognize, protect and maintain IPRs; monitor and exploit the commercial value of these and perform IP audits and valuations, capacity building of all concerned, also needs to be strengthened from time to time.

During the building of an idea from concept to innovation, a simple prior-art search at the beginning not only spares the time and energy of the inventors, but also guide them to overcome the inventive-step issues. Yet, this basic knowledge seems missing among the researchers and scientists, especially in agriculture research institutions. This lack of IP awareness among science professionals and young researchers including students, slackens their innovativeness leaving the intellectual properties generated by them unprotected. Therefore, regular interactions between IP Cell and researchers should be promoted at institute/ college/ university levels. Researchers in the phase of ideation itself should be made aware of the criticality of desirable IP protection. They should be hand-held in an effectual way by the IP Units of the organisations. Being in a research institute, surrounded by numerous novel technologies, we felt there is a sheer gap between the inventors/ researchers and the IP personnel. A need in the ability to clearly demarcate different types of IPRs among innovators has also been observed. At institutional levels a provision is required to be made, wherein the researchers/ scientists shall demonstrate from time to time the technologies in which they are working to the internal review committee and the IP Cell to enable early identification of potential innovations. This will create an environment of familiarity and regular interactions with the IP Cell, thereby protecting the technologies at a very early stage.

Another vital action to be taken by the research institutions is to perform IP audits frequently i.e. every three years, thereby making decisions to put the obsolete technologies in public domain. This will save huge sum of money for the organization that is spent on maintaining these patents. Last, but not the least, IP watch shall be established at the institutions to effectively monitor the IPRs filed and granted/ registered within their prescribed timelines.

Based on the above observations, different IP departments of the government owned/funded institutions should come forward and organize trainings/ workshops/ seminars for IPR awareness and thereby contribute in the knowledge economy of the country. Nevertheless, the role of national IP office in creating IP awareness among public from time-to-time basis is the need of the hour.

When it comes to the matter of technology transfer, challenges perceived at the inventor/ researcher/ scientist's level relate to licensing of the technologies at very low technology readiness levels (>3-4), thereby leading to change in dynamics when they are upscaled by the industries; low deliverance of turn-key projects by researchers/ scientists due to lack of industry exposure and industry interactions and also because they are not equipped enough to handle such projects. Another big challenge observed is that know-how based technologies which are licensed by the institutes are not upgraded with time, thereby leaving the licensees with a single, never evolving technology and lesser chance of renewal of license agreements. This creates a barrier in the advancement of technologies. Hence, this practice should be circumvented.

Some of the major tech-transfer related challenges faced at the institute's level pertained to issues related to poor royalty realization and lack of a system of mapping of royalties. Therefore, legal services should be provided by the institute for due incentivization of the inventors for their hard-work and to evade unforeseen challenges in the tech-transfer matters. Other challenges at institute level comprise of inadequate budgeting



PATENTED

to back up IP transfer affairs; retention of the skilled personnel (due to fixed/ consolidated salary structure); lack of experts for IP and business management i.e. marketing, promotions, market analysis of institute's research based technologies etc. In addition, market research and valuation of the technologies are not done to a great extent at the institute level and suitable provisions need to be established for the same. Further, it is time that exclusive licensing be considered for high-end technologies developed by the institute in which investment was high. Necessary Guidelines are needed to be integrated at the national policy levels.

Mere scrutiny of these challenges lead to the urgency of the intervention of the GoI in policy matters of technology transfer offices (TTOs) and expansion of National IPR Policy to encompass broader avenues of technology transfer. Steps towards establishment of more and more Technology Management offices be considered by the GoI to not only transfer the technologies developed by the innovators/ organizations, but also to provide training to the technology transfer professionals. A committee comprising of stakeholders from various fields under the guidance of experts be contemplated by GoI to frame a standard protocol for functioning of technology transfer offices in the country and provide necessary advisory to the TTOs from time to time. This committee can also act as a panel of advisors in drafting and implementation of guidelines and policies of the TTOs.

IP and TTOs should be made a compulsory component of every academic and research institute's infrastructure. Facilities of IP protection and management, technology transfer, technology valuation and validation etc. should be offered by these offices at reasonable fees/ rates. Additionally, the inclusion of IP as a subject in every academic institution starting from school level should be mandated at academic level.

The last challenge which the authors wish to highlight is the counterfeiting of the products, technologies, crop varieties for which IP has already been applied. Being a research institute we have come across of the incidents that certain crop varieties (for which we have not licensed the technology to a particular party), are being sold by the unauthorized third parties with their names. Such incidents should be condemned at every level. For this, strict statutory guidelines/ policies at national level in usage of protected technologies without taking its license should be drafted and implemented. Such approach will curtail the risk of technologies/ products coming into market without owner/ applicant's knowledge.

The vision of 'Self- Reliant India', envisaged by Hon'ble Prime Minister of India can be met only if the innovations squirting from the research labs/ an innovator's workshop are suitably protected under required IP regime. Being 'Vocal for Local', as stressed by Prime Minister again in the line of making India self-reliant, will also boost the Indian innovations and the consumers will pick the Indian products over foreign brands. The role of IP and technology transfer over again comes into play in this approach and it will help in placing the Indian products in global space.

