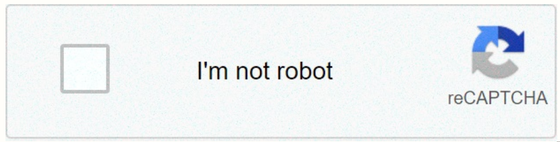

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Plant Biotechnology Patents: Applications in Agriculture and Medicine

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Abstract: Recent advances in agricultural biotechnology have enabled the field of plant biology to move forward in great leaps and bounds. In particular, recent breakthroughs in molecular biology, plant genomics and crop science have brought about a paradigm shift of thought regarding the manner by which plants can be utilized both in agriculture and in medicine. Besides the more well known improvements in agronomic traits of crops such as disease resistance and drought tolerance, plants can now be associated with topics as diverse as biofuel production, phytoremediation, the improvement of nutritional qualities in edible plants, the identification of compounds for medicinal purposes in plants and the use of plants as therapeutic protein production platforms. This diversification of plant science has been accompanied by the great abundance of new patents issued in these fields and, as many of these inventions approach commercial realization, the subsequent increase in agriculturally-based industries. While this review chapter is written primarily for plant scientists who have great interest in the new directions being taken with respect to applications in agricultural biotechnology, those in other disciplines, such as medical researchers, environmental scientists and engineers, may find significant value in reading this article as well. The review attempts to provide an overview of the most recent patents issued for plant biotechnology with respect to both agriculture and medicine. The chapter concludes with the proposal that the combined driving forces of climate change, as well as the ever increasing needs for clean energy and food security will play a pivotal role in leading the direction for applied plant biotechnology research in the future.

Keywords: Plant biotechnology, transgenic plant, phytoremediation, biofuel, drought tolerance, pathogen resistance, edible vaccine, nutraceutical.

INTRODUCTION

It takes merely a quick glance at the literature to realize that a novel and robust collection of patents can be attributed to recent developments in the field of plant science. The expanse of inventions is impressive and range in diversity from crops which exhibit disease resistance and herbicide tolerance to the use of plants in biofuel production, and even further to plants with enhanced nutritional or therapeutic qualities. This review provides an overview of biotechnological applications using plants for both agricultural and medicinal purposes. In order to keep the size of this review to a reasonable length, a selection of only the most recent patents which have been issued over the last three years for a restricted number of topics have been covered.

APPLICATIONS IN AGRICULTURE

The applications of biotechnology in agriculture are many. These include crops which exhibit reduced dependence on fertilizers, pesticides and other agrochemicals, reduced vulnerability of crops to environmental stresses including drought tolerance, disease resistance, as well as plants which can be used for phytoremediation purposes and biofuel production. The next section and Table **1** details recent patents which relate to these topics.

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HERBICIDE RESISTANCE

The introduction of herbicide-tolerant crops has the potential of reducing the amount of herbicide used for weed management, thus reducing the number of herbicide applications made during a growing season and increasing the yield. These herbicides can now be sprayed on transgenic crops without inflicting damage on the crops while simultaneously inhibiting the growth of neighbouring weeds.

The herbicide glyphosate [N-(phosphonomethyl)glycine] is the most used herbicide in the USA, and has been the dominant herbicide worldwide since it was introduced to the commercial market in 1974 [1]. Transgenic, glyphosate-resistant crops were first made available in 1996, and close to 90% of all transgenic crops grown across the world exhibit glyphosate resistance. Glyphosate's mode of action is to target and inhibit 5-enolpyruvyl-shikimate-3-phosphate synthase (Class I EPSPS), the enzyme involved in the synthesis of the amino acids tyrosine, tryptophan and phenylalanine, which in turn are used as building blocks in peptide synthesis. These amino acids are also used to produce a number of secondary metabolites, including folates, ubiquinones and naphthoquinone [2].

Another important gene in the history of herbicide resistance is the herbicide bialaphos (*bar*) gene. The *bar* gene was originally cloned from *Streptomyces hygroscopicus*, an organism which produces the tripeptide bialaphos as a secondary metabolite. Bialaphos contains phosphinothricin, an analogue of glutamate which is an inhibitor of glutamine synthetase. Bar has been used both to create

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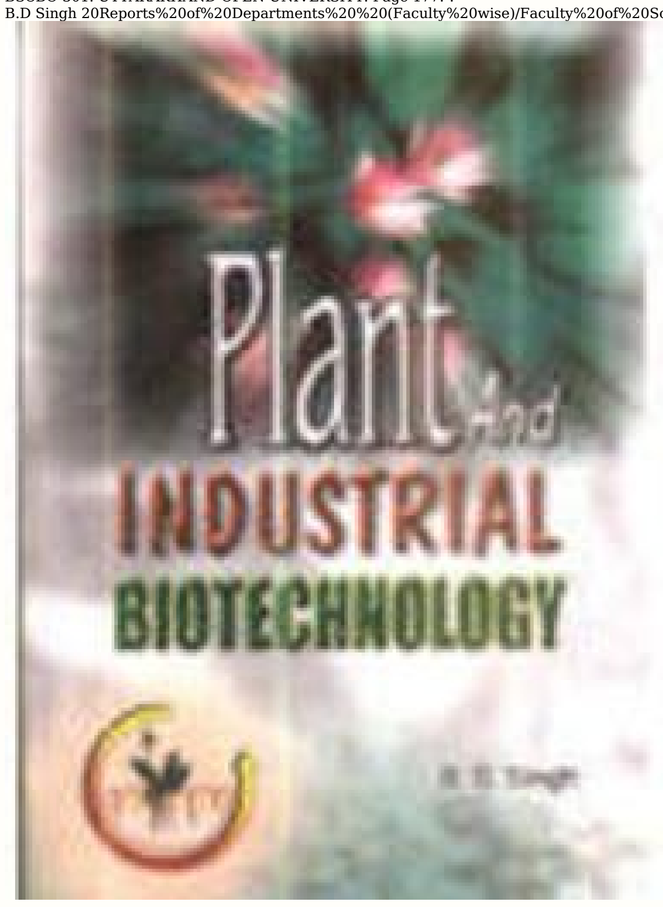
B.D Singh 20Reports%20of%20Departments%20%20(Faculty%20wise)/Faculty%20of%20Science/School%20of%20Biotechnology.pdf Biotechnology B D Singh Kalyani Publication. 2. Introduction to Applied Biology and Biotechnology. K Vaidyanath Fundamentals of Genetics- B.D. Singh. SEMESTER III. BTM -211: Molecular Biology (3+0). 1.



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Varanasi UP Basic Cell Culture 2 nd Edition by JM Davis Oxford Press • Tissue Culture in Biological Research by G Penso and D Balduki • Biotechnology by B D Singh In vitro Culture of Higher Plants Kluwer Singh BD 2007 Biotechnology: Expanding Horiozon Kalyani MBB 505 TECHNIQUES IN MOLECULAR BIOLOGY -I Textbook of Biochemistry- S P Singh 5 Biochemistry 8 Experiments in Biotechnology, Nighojkar and Nighojkar Text Book of Biotechnology, B D Singh Animal Biotechnology, Shashidhara R 19 Text Book of Biotechnology, B D Singh Culture of Animal cell, Freshney SEMESTER V - EXPERIMENTS Elsevier 2067 1 4 Biotechnology B D Singh Kalyani 154,240,315-344, 32 5 Biotechnology Bissen Thiel TMH 39,40 2 6 Basic Biotechnology Total 1 Plant Breeding B D Singh Kalyani 703,720,910-913,964-969, 2668- 2677 22 2 In Vitro Cultivation plant cell Butterworth Heinomann Linacremouse PDF document for free [PDF] biotech correction [PDF] biotechnology [PDF] biotechnology about agriculture [PDF] biotechnology about cloning [PDF] biotechnology about courses [PDF] biotechnology about foods [PDF] biotechnology about genetic engineering [PDF] biotechnology about medicine [PDF] biotechnology abroad [PDF] biotechnology abroad jobs Brahma Deo SinghBrahma Deo Singh is currently Emeritus Professor at School of Biotechnology, Banaras Hindu University, Varanasi, India. He obtained his Bachelor's degree in agriculture from Allahabad Agricultural Institute, Allahabad, India and Master's degree in Agricultural Botany from Government Agricultural College, Kanpur, India with first position in the university, and was awarded the University Gold Medal. He earned his Ph.D. degree from University of Saskatchewan, Saskatoon, Canada. Prof. Singh has 40 years of teaching and research experience in the areas of genetics and breeding of pulse crops, plant tissue culture, biological nitrogen fixation, and molecular markers. He has published over 150 research papers in reputed journals and authored several books in genetics, plant breeding and biotechnology. He was awarded the First Prize of the Dr. Rajendra Prasad Puraskar in 1987 and 1990 by the Indian Council of Agricultural Research, New Delhi for the books PadapPrajanan and Anuvanshiki, respectively. Ashok Kumar SinghAshok Kumar Singh, Fellow of National Academy of Agricultural Sciences, India, is at present Head, Division of Genetics at the prestigious Indian Agricultural Research Institute, New Delhi. He completed his bachelor's and Master's degrees from Banaras Hindu University, Varanasi, India, and obtained his Ph.D. degree from the institute where he is currently working as a dedicated teacher and rice breeder. He has been associated with the development of eleven Basmati rice varieties, including the first superfine grain aromatic rice hybrid Pusa RH 10, which combine earliness with higher yield and higher per day productivity with excellent grain and cooking quality. He has successfully integrated marker-assisted selection for incorporating resistances to bacterial blight, blast, brown plant hopper drought, salinity and submergence in rice varieties. His current research interests include TILLING, bio-prospecting for genes and novel alleles, and marker-assisted breeding in rice. He is well recognized for his contributions to Basmati rice breeding and marker-assisted breeding. He has over 70 research publications in journals of international repute, and he has been honoured by several awards, including Borlaug Award-2012, Rafi Ahmad Kidwai Award-2013 for research contributions and Bharat Ratna Dr. C. Subramaniam Award-2013 for contribution to teaching. Page 2Agarwal M, Shrivastava N, Padh H (2008) Advances in molecular marker techniques and their applications in plant sciences. printable staff paper pdf Plant Cell Rep 27:617–631CrossRef CAS PubMed Google Scholar Bentley DR, Smith AJ (2008) Accurate whole human genome sequencing using reversible terminator chemistry. 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