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little scope for plant breeder to make changes in the bred traits. As a result, new varieties are often released with disappointing results in terms of the rate and extent of adoption by farmers, even in areas where the varieties have been targeted. Participatory approaches in a highly market oriented context are very effective at identifying varieties that will be adopted by farmers however, the farmers selection criteria include a very narrow set of market oriented characteristics. In large part participatory breeding combined with decentralized selection under high stress conditions, has arisen as a breeding strategy to attempt to improve the formal breeding for difficult environments.

**MICROBIOLOGY**

**INCREASED PLANT FITNESS BY ACC DEAMINASE CONTAINING BACTERIA**

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Ethylene, which is produced in almost all plants, mediates a range of plant responses and developmental steps. Ethylene is involved in seed germination, tissue differentiation, formation of root and shoot primordial, root elongation, lateral bud formation flowering, initiation, anthocyanin synthesis, flower opening and senescence, fruit ripening and degreening, production of aroma, leaf and fruit abscission and response of plants to biotic and abiotic stresses. The term "stress ethylene" was coined by Abeles (1973) to describe increased level of ethylene formed due to trauma inflicted by temperature extremes, water stress, ultraviolet light, chemicals, mechanical wounding, insect damage and disease etc. In 1978 an enzyme capable of degrading ACC (1-aminocyclopropane-1-carboxylic acid) which is a precursor of ethylene, thus reducing the inhibition of root growth by stress induced ethylene was isolated from *Pseudomonas* sp. (Honma and Shimomura, 1978). Since then ACC-deaminase has been detected in a number of bacteria, yeast and fungus species. Many of plant symptoms from an environmental stress occur as a result of the response of the plant to the increased levels of stress ethylene. And not only does exogenous ethylene often increase severity of the response but as well inhibitors of ethylene synthesis an significantly decrease the severity of environmental stress. Moreover, by acting as a sink for ACC, ACC deaminase plant growth promoting bacteria can act to modulate the levels of ethylene in a plant. It may help in increasing plant fitness by influencing a number of parameters like -

**Flower Senescence**

Ethylene is a key signal in the initiation of wilting in most plants. Typically flowers, produce minute amounts of ethylene until an endogenous rise of the phytohormone, which is responsible for flower senescence occurs (Moletal., 1995). However, the senescence symptoms that are covered by ethylene differ from plant to plant. The use of ACC deaminase containing plant growth promoting rhizobacteria to lower ACC levels in cut flowers might be an environmentally friendly alternative to the available use of silver thiosulphate.

**Flooding**

Flooding is a common biotic stress that is faced by many plants, several times during the same growing seasons. A lack of oxygen in the roots is the main consequence, which in turn leads to epinasty, leaf chlorosis, necrosis and reduced fruit yield. As a result of stress the ACC synthesized is transported into aerobic shoots where it is converted to ethylene resulting in deleterious effects. It has been found that as a result of the presence of PGPR with ACC deaminase on the roots of tomato plants, there was a statistically significant overall plant growth, leaf chlorophyll content and substantially decreased ethylene production in leaf petiolar tissue (Grichko and Glick, 2001).

**Metal Stress**

One way to relieve the toxicity of heavy metal to plants might involve the use of PGPR, applied to the seeds or incorporated into the soil. The PGPR that contain ACC deaminase stimulated Canola root and shoot growth in presence of toxic levels of nickel. The presence of this bacterium had no measurable influence on the amount of nickel accumulated per mg dry weight of either roots or shoots but it reflects the ability of *Kluyvera ascorbata* to lower the level of stress ethylene caused due to Nickel (Burd et al., 2000). The data suggests the same ability with other heavy metals like lead and zinc.

**Temperature**

It has been reported that PGPR containing ACC deaminase activity performs better when subjected to diurnal temperature regime. *Bacillus globiosporus* was inoculated to analyze the effect of diurnal temperature regime (ie. 25°C days and 5°C night).
INFLUENCE OF TIME ON PHOSPHATE SOLUBILIZATION AND IAA PRODUCTION IN RHIZOBACTERIAL ISOLATES OF CICER ARIETINUM.

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Keywords: PGPR's, Phosphate Solubilization, IAA Production.

ABSTRACT:

Different sixteen rhizobacteria, isolated from Cicer arietinum rhizosphere, were screened for their phosphate solubilization (TCP) and IAA production ability. Out of them, 11 showed significant phosphate solubilization both on solid and in liquid medium along with considerable pH reduction. Phosphate solubilized 320 ppm/ml to a maximum of 440 ppm/ml after 14d of incubation. Isolate CP11 solubilized 320 ppm/ml phosphate in liquid medium with 5.3 pH and 18mm of solubilization zone on solid medium. IAA production, using Salkowsky's reagent method, ranged between 1 ug/ml 22.2 ug/ml. CP11 once again showed a maximum of 22.2 ug/ml IAA production after 10d of incubation. Results reveal that CP 11 has a capacity of being a potential biofertilizers.

Introduction:

The use of soil microorganisms as biofertilizers is one of the most promising biotechnologies to improve primary production with low inputs of fertilizers (Lucas et al, 2000).
The effect of plant growth promoting *Pseudomonas* on the growth of *Trigonella foenum* was evaluated. The seedlings were grown on sterilized sand and inoculated using different inoculums. Positive and negative controls were used. The present study highlights the contributions made by live and dead biomass of *Pseudomonas* and it is also compared with plants supplied only with Murashige and Skoog nutrient solutions. *Trigonella* seedlings were found to be more responsive to treatment with live culture of *Pseudomonas*, although a low level of growth promotion was also observed when plants were treated with autoclaved biomass of *Pseudomonas*. However, the use of MS solution showed little or no stimulation in growth of seedlings. Among the three stains of *Pseudomonas* tested, *Pseudomonas* TP2 showed maximum increase in vegetative parameters like shoot and root length, weight of plants, lateral root formations and chlorophyll content of leaves.

**KEY WORDS** *PSEUDOMONAS*, MS SOLUTION, DEAD BIOMASS, VEGETATIVE GROWTH

**INTRODUCTION**

Rhizosphere microorganisms which are closely associated with roots have been termed as Plant Growth Promoting Rhizobacteria (PGPR). The use of *Pseudomonas* as a PGPR has been well documented, both at early stages (Dileepkumar *et al.*, 2001; Sharma *et al.*, 2003) and also up to yield stage (Defrietas *et al.*, 1992; Kropp *et al.*, 1996). They bring about a number of changes like tolerance to environmental conditions, solubilization of phosphorus, ability to produce antibiotics, hydrocyanic acid, phytohormones, siderophores etc. (Xie *et al.*, 1995). Indole acetic acid is known to stimulate both rapid and long term responses in plants (Cleland, 1990). The PGPR used towards the end of last century gave inconclusive results causing this approach to be largely abandoned (Bashan, 1998). However, with recent interest of replacing chemical fertilizers with bioinoculants efforts are directed at a better level of understanding the role of these microbes in the soil ecosystem. The majority of the laboratory studies with PGPR have been conducted under axenic conditions in which the impact of PGPR on plant growth is generally recorded independent of chemical composition of soil. A large number of researchers have tried to review applications of free living plant growth promoting rhizobacteria (Reed, 2004). Generally a less pronounced stimulation of plant growth achieved under field conditions is explained by various interactions with external factors affecting growth processes in opposite direction.

The present study examined the effect of three species of plant growth promoting bacterium *Pseudomonas* on the vegetative growth of the *Trigonella* plant. In addition to this, the effect of the bacteria in combination with added nutrients was also studied to gain an understanding about the role of live bacteria, dead bacteria, nutrient solutions and Distilled water used on sand which is virtually nutrient free.

**MATERIALS AND METHODS**

Out of the three cultures used one was a known culture TP3 - *Ps. aeruginosa* MTCC 2582. The other two were identified as TP5 - *Ps. mendocina* and TP4 - *Ps. solanecarum*. All bacteria were fluorescent and produced catecholate type of siderophores. *Pseudomonades* were grown on Kings Medium at 37°C for 24h under shaking conditions (i.e. approx. 150rpm) to ensure proper aeration. Following growth, the bacterial
Potential Microorganisms for Sustainable Agriculture
A Techno-commercial Perspective

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Rhizomediation in Soil for Sustainable Agriculture

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ABSTRACT

Rhizobial microbiology, plant nutrition, and soil science have diverged from their traditional science into new directions within the last decade. Likewise, the basic concepts on plant-microbe interaction, mineral-nutrient exchange, and soil acidity-alkalinity requirements have been customized to fit into the track of emerging "rhizomediation". The recent empirical observations on induced chemical signalling between microbes and plants as well as the acquisition of mineral nutrients in the rhizosphere have paved the way to understanding the insight into this field. In addition, modern methods adapted from Molecular Biology and Biotechnology have already established the significance of rhizomediation as a promising field of interest. In this review, accumulated knowledge on the management of rhizosphere, basic concepts and insights, application of modern techniques and major challenges in this field have been discussed to improve the crop yield for sustainable agriculture.

INTRODUCTION

A decade ago, the success of the "green revolution" was totally dependent on the augmented contribution of fertilizer nitrogen. Approximately 90 million tonnes of fertilizers were applied annually to agriculture land (Sprent and Sprent, 1990). Since then, the natural process of Biological Nitrogen Fixation (BNF) has played a significant role as an environmentally safe and sustainable
Research Paper
Enhancement of plant growth and decontamination of nickel-spiked soil using PGPR
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KEYWORDS
Phytoremediation • Nickel contamination • PGPR • Siderophore • Nickel accumulation

ABSTRACT
Phytoremediation i.e. the use of plants to adsorb, accumulate or detoxify contaminants is an emerging area of interest. A viable technology needs optimum biomass production in metal contaminated soil. Five strains of microbes were selected after testing their potential as plant growth promoters, on the basis of their phosphate solubilization ability, IAA, siderophore and HCN production and biocontrol potentials. They were examined for growth in synthetic medium supplemented with nickel and their MIC (2 mM) was determined. These isolates were also able to grow and produce siderophores in presence of heavy metals like Ni, Zn and Cd. A positive response of bacterial inoculants was observed in chickpea plants towards toxic effect of nickel present in soil at different concentration (0, 1 and 2 mM). Bacterial inoculants enhanced fresh and dry weight of plants even at 2 mM nickel concentration. Pot experiments indicated that presence of nickel at upto 1 mM enhanced plant growth compared to uninoculated nickel free plants. The accumulation of nickel/plant was just 50% in Pseudomonas inoculated plants as compared to uninoculated plants with 2 mM nickel concentration along with increased biomass. The results suggest the use of these PGPR to enhance plant growth in nickel-spiked land and remediate nickel from contaminated sites. (© 2008 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim)

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Tank N. D. and Saraf M. S. “Plant growth promoting fluorescent pseudomonas decreases heavy metal toxicity in plants.” 47th AMI conference, Barkatullah University, Bhopal Dec, 6-8 2006, pg. 143


ORAL PRESENTATIONS:


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