Current World Environment Vol. **5**(1), 99-100 (2010)

Effect of pesticide degradation on the growth of cotton variety RCH2

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(Received: October 10, 2009; Accepted: November 22, 2009)

ABSTRACT

The pesticides are known for the control of pests as well as on the other hand these are hazards for human, animal, plants and microbial life. To degrade the pesticides, biodegradation is an efficient method. The Plant Growth Promoting Rhizobacteria (PGPR) which are associated with the rhizosphere of the plant are found to be beneficial for the pesticide degradation in the soil. In the present investigation, these bacteria were used for the pesticide degradation. The effect of pesticide degradation on by PGPR on the growth of cotton variety RCH2 was studied. With the application of PGPR along with pesticide, Malathion the growth of cotton variety was found improved in some cases while as compare to control this growth was slightly less.

Key words: Pesticide, degradation, PGPR, Malathion, cotton, growth.

INTRODUCTION

The pesticides are widely used in the agriculture and households throughout the world. The total pesticide consumption was estimated to 5 billion pounds by the year 2000-2001 (Report of US Environmental Protection Agency). In India the usage of pesticide is tremendous that is 46195.16 metric tones by the year 2000 (Report of Indian pesticide registration committee). The pesticides include various chemicals such as orgaanochlorides, organomercurials, organophosphates etc. These are used for the protection of crops against various pests. However, their residues get leached into the soil and the amount in the soil is increased beyond minimum residue level.

The residue of these pesticides became hazardous to the microbial balance of the soil (Rachael 2003). The microbes which are beneficial to the plants are also affected by them. The degradation of the pesticide is therefore an important task now a day. In the soil, for the degradation of residual pesticide, use of bacteria, fungi and actinomycetes is well known (Matsumura, 1974). While degrading the pesticides it is necessary to study the properties of plant growth promoting rhizobacteria (Wu et al., 2005, Zhuang *et al.,* 2007). To check weather they alter their property of plant growth enhancement, the present investigation was carried out.

MATERIAL AND METHODS

Plant Growth Promoting Rhizobacteria were isolated from the leguminous plants, soil and sugarcane rhizoplane. The *Rhizobium meliloti* was isolated on the Yeast Extract Mannitol Agar medium (K_2HPO_4 -0.05g, $MgSO_4.7H_2O$ 0.2 g, NaCl -0.1g, Mannitol -10 g, Yeast extract – 0.4 g, Agar 15 g, distilled water – 1000 ml) from *Trigonella foenm graecum*. The *Azatobacter chrococcum* was isolated from the soil on the Thompson and Skerman medium(di-potassium hydrogen phosphate,-1g, calcium chloride – 0.1g, magnesium sulphate - 0.2g, sodium molybdate - 0.005g, glucose – 10g, distilled water – 1000 ml, pH 7.3). The *Pseudomonas fluorescens* was isolates from the soil using King's medium (protease peptone -10 g, dipotassium phosphate- 1.5 g, magnesium sulphate- 1.5g, agar agar -15 g, distilled water 1000 ml). The *Bacillus polymyxa* was isolated from the soil using nutrient agar (peptone -10g, beef extract

-2g, sodium chloride -2g, distilled water 1000 ml, agar 15 g). The *Azospirillum lipoferum* was isolated from sugarcane rhizoplane on MPSS medium (peptone -5 g, succinic acid – 1 g, ammonium sulphate – 1g, magnesium sulphate -1 g, ferric chloride - 0.002 g manganese sulphate – 0.002 g, distilled water -1000 ml, pH 7 adjusted with KOH). These bacteria were confirmed according to Bergey's Manual of Systematic Bacteriology. The pure culture was multiplied and further used. The pots were filled with sterilized soil. The cotton seeds were soaked with the suspension of PGPR and treated with Malathion and sown in the sterile soil. The irrigation was done at regular interval. The growth of the cotton plants was measured in terms of height of the plant, number of leaves, biomass, and after harvesting the amount of nitrogen was estimated by Kjheldal's method.

RESULTS

Table 1 indicates that the growth was found promoted by PGPR when treated with the Malathion. Out of the five bacterial treatments, the plants treated with the Malathion and the bacterium *Bacillus polymyxa* was found more efficient in nitrogen content while the plants treated with Malathion but without any bacterial treatment also showed the maximum nitrogen content. The biomass was increased with the treatment of *Azospirillum lipoferum*. The singly Malathion treatment was also found beneficial for the biomass increase in the plants. The bacterium, *Azospirillum lipoferum* treatment to the cotton showed better germination, number of leaves and maximum height of the plant. The combined treatment of all the five bacteria showed better growth of the cotton plant.

Table 1: Effect of Malathion degradation by PGPR on the growth of cotton variety, RCH2

Bacterium	Germination %	Height of plant in cm	Number of leaves Biomass(g)	N_2%
Rhizobium	40	8	5	0.492 1.9159
Pseudomonas	50	5	4	0.276 1.8326
Bacillus	50	7	6	0.489 2.5823
Azotobacter	50	10	7	0.521 1.8326
Azospirillium	50	11	8	0.631 1.9159
Combine	50	10	8	0.543 2.6656
Malathion	30	10	8	0.696 2.4157

DISCUSSION

Thus the treatment of plant growth promoting bacteria along with Malathion didn't affect the plant growth therefore it can be concluded that the pesticide degradation by the microbes is an independent process. In this investigation it can also be concluded that the Malathion degradation reduced the growth of the plant in individual bacterial treatment as compare to control i.e. Malathion. This may be due to toxicity of the Malathion degradation products (Duke et al., 1991).

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