As. J. Food Ag-Ind. **2009**, Special Issue, S66-S68

Asian Journal of Food and Agro-Industry
ISSN 1906-3040
Available online at www.ajofai.info

Short Communication

Effectiveness of Pichia sp. CC1 in decreasing chemical fertilization requirements of garden lettuce in pot experiments

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This article was originally presented at the International Symposium "GoOrganic2009", Bangkok, Thailand, August 2009.

Abstract

Yeast is a one of the beneficial microbes with plant growth promoting traits such as increasing the availability of phosphorus in the soil. In the present study, three yeast strains were selected to study the effects of bio-fertilizer on lettuce plants in pot experiments. These yeast isolates all showed phosphate solubilizing activities in tri-calcium phosphate media. A combination of yeast strain *Pichia* sp. CC1 and a half dose of chemical fertilizer (½CF) showed lettuce dry weight increased to 107% compared with only ½CF was used alone. The nutrient (N, P, K, Ca, Fe, Mn and Zn) content of plants also significantly increased when compared with those of ½CF treatment.

Keywords: *Pichia* sp. CC1, *Rhodotorula* sp. CC2, *Candida* sp. CC3, biofertilizer, yeast

Introduction

The microbial bio-fertilizers are abundantly useful for sustainable agriculture. There are only a few studies of yeast in the root and in the rhizosphere [1]. Singer *et al.* [2], investigated the synergistic effect of bio- and chemical fertilizers for improving quality yield of snap bean when inoculated with *Azospirillum lipoferum* and soil yeast (*Candida* sp.) and mixed with 50, 70% NPK under soil condition. The present research work was undertaken to investigate the effectiveness of yeasts for promoting plant growth and decreasing chemical fertilizer requirements of garden lettuce plants in pot experiments.

Materials and Methods

A randomized complete design pot experiment was conducted in a greenhouse. Lettuce seeds were sown in pots that contain 500 g clay soil per pot. Three yeast cultures with and without chemical fertilizers were used. After 49 days the plants were harvested and their dry weight and nutrient content were determined. Mineral phosphate solubilizing activities of yeasts were determined by spectrophotometry analysis. Statistical analysis was done using ANOVA program with Costat software.

Results and Discussion

Effects of yeast inoculation on the growth of lettuce plants

In the pot experiment, the highest growth of lettuce was found in ½CF combined with *Pichia* sp. CC1 treatment. Only the CF treatment showed ability to increase lettuce fresh and dry weight by 108% and 107%, respectively, compared with half dose of CF used alone. These results agree with of those of El-kholy and Gomaa [3], which showed that the biofertilizer could replace fifty percent of the chemical fertilizer recommended for millet plants.

Mineral phosphate solubilization ability of yeasts and nutrient contents of lettuce plants

Pichia sp. CC1 showed the highest water soluble P contents (190.78 $mg \cdot L^{-1}$), followed by *Candida* sp. CC3 and *Rhodotolura* sp. CC2, with 170.42 and 97.69 $mg \cdot L^{-1}$ respectively. This result correlated with the phosphorus content in lettuce as *Pichia* sp. CC1 plus ½CF showed the highest amount of phosphorus in plants. Varsha *et al.* [4] showed that the phosphate solubilizing yeasts (PSY) which belong to the genus *Saccharomyces*, *Hansenula*, *Klockera*, *Rhodotorula* and *Debaryomyces* exhibited highest solubilization index (SI) for in vitro tri-calcium phosphate and rock phosphate.

In addition, the inoculation of yeasts *Pichia* sp. CC1 with ½CF fertilizers significantly increased N, K, Ca, Mg, Fe, Mn and Zn content than when only ½CF or other treatments were used, except CF fertilizer application.

Conclusions

The present work represents a preliminary study on the investigation and selection of suitable yeasts as inoculants to promote plant growth. The future work will be planned to explore the plant growth promoting mechanisms of these yeasts and to develop more effective biofertilizers by using microbial consortium.

Acknowledgements

This research work was kindly supported by grants from National Science Council and Council of Agriculture, Executive Yuan, in part by the Ministry of Education, Taiwan, under the ATU plan.

References

1. Golubtsova, Y., Glushakova, A. and Chernov, I. (2007). The seasonal dynamics of yeasts communities in the rhizosphere of Soddy- podzoic soils. **Eurasian Soil Science**, Vol. 40(8), pp. 875-879.

2. Singer, S.M., Ali, A.H., El-Desuki, M.M., Gomaa, A.M. and Khalafallah, M.A. (1998). Synergistic effect of bio-and chemical fertilizers to improve quality and yield of snap bean grown in sandy soil. In Internationnal Horiculture Congress, Part 3: Culture Techniques with Special Emphasis on Environment Implications, Disease, Pest Control and Integrated Pest Strategies. ISHS.

3. El-Kholy, M.A. and Gomaa, A.M. (2000). Biofertilizers and their impact on forage yield and N-content of millet under low level of mineral fertilizers. **Annals of Agriculture Science**, Vol. 38, pp. 813-822.

4. Varsha, N., Ahmed Abu Samaha, S.M. and Patel, H.H. (2008). Rock phosphate dissolution by specific yeast. **Indian Journal of Microbiology**, Vol. 48, pp. 1-6.