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Research Article

Role of *Bacillus circulans* - A bacterial fertilizer on yield quality and economics of aniseed *(Pimpinella anisum)*

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ABSTRACT : An experiment was laid out on degraded sandy loam soil during winter season of 2004-2005 and 2005-06 at Regional Research Station, Mainpuri, C.S. Azad University of Agriculture and Technology, Kanpur. The main objective was to increase the quantitative and qualitative production of aniseed on riverine soils of Uttar Pradesh through integration of bacterial fertilizer with recommended dose of NPK. The five level of *Bacillus circulans* containing bio fertilizer *i.e.*, 0, 10, 15, 20 and 25 kg/ha were tested in association of 80 kg N+40 kg P_2O_5 + 40 kg K_2O/ha. Application of *Bacillus circulans* containing bio fertilizer @ 20kg/ha or 2.00 lakh carror bacteria per hectare registered higher seed yield of aniseed by 15.10 q/ha over control (11.40 q/ha) and lower installments of *Bacillus circulans* containing bio fertilizer during both experimental seasons. The installment of *Bacillus circulans* containing bio fertilizer beyond 20 kg/ha confined to the further progress in aniseed production. The produce obtained from the *Bacillus circulans* applied plots showed marketable bright green colour over the produce of control plots. The chewing taste of aniseed kernels obtained from bacterial fertilizers treated plots was better than the control plots product.

KEY WORDS : *Bacillus circulans*, Riverine soils, Natural inoculation, Chewing quality, Asthma

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INTRODUCTION

Aniseed (*Pimpinella anisum*) is known for its ability to reduce wind and bloating and to settle the digestion. It is commonly given to infants and children to relieve colic and to people of all ages to ease nausea and indigestion. Aniseed antispasmodic properties make them helpful in countering period pain, asthma, whooping cough and bronchitis. The seeds expectorant action justifies their use for these respiratory ailments. Aniseeds are thought to increase breast-milk production and may be beneficial in treating impotence and frigidity. Aniseed essential oil is used for similar complaints and is also used externally to treat lice and scabies.

Inoculation of plants with beneficial bacteria started centuries age. Farmers learnt it from experience that when soil taken from a previous legume crop is mixed with soil in which non- legumes is to be grown, yield often improves. By the end of 19th century, the practice of mixing naturally inoculated soil with seeds because a recommended method of legume inoculated in the USA (Smith, 1992). Pioneering work on the effect of micro- organism on plant growth and yield was conducted in the former USSR in the 1940s with non symbiotic bacteria *Bacillus megaterium* var. *phosphaticum*, this was used on cereals over 10 million hectares (Brown *et al.*, 1964)

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Table 1 : Yield, cost and return under different treatments

Treatments	Kernels yield (q/ha)			Cost of cultivation (Rs/ha)	Gross return (Rs./ha)	Net return (Rs/ha)	B:C ratio
	2004-05	2005-06	Pooled				
Bacillus circulans fertilizer @ 0 kg/ha	10.50	12.30	11.40	15000	114000	99000	1:7.60
Bacillus circulans fertilizer @ 10 kg/ ha	12.10	12.00	12.05	15600	120500	104900	1:7.72
Bacillus circulans fertilizer @ 15 kg/ ha	13.50	13.30	13.40	15900	134000	118100	1:8.42
Bacillus circulans fertilizer @ 20 kg/ ha	14.80	15.40	15.10	16200	151000	134800	1:9.32
Bacillus circulans fertilizer @ 25 kg/ ha	14.90	15.00	14.95	16500	149500	133000	1:9.06

Sale price of aniseed - Rs. 10000/q

for the putative effects via phosphate solubilization.

In U.P., the biological plant growth enhancer in the form of *Bacillus circulans* containing bacterial fertilizer was tried on partially reclaimed sodic soils and normal soils in districts Mainpuri and Kanpur for the first time to produce summer groundnut. Application of *Bacillus circulans* containing bacterial fertilizer @ 16 kg in association of RDF increased the pod yield about 85% over the control in salt affected soils (Singh, 2007). In the present experiment *Bacillus circulans* bacteria was used in aniseed, grown during winter season to identify its efficiency in semi- arid- environment, is the subject matter of this manuscript.

EXPERIMENTAL METHODS

The present experiment was carried out during winter season of 2004-05 and 2005-06 at Regional Research Station, Mainpuri, C.S. Azad University of Agriculture and Technology, Kanpur. The soil of experimental site was sandy loam and degraded nature having pH 8.5, organic carbon 0.45%, total nitrogen 0.04%, available phosphorus 10 kg/ha and available potash 278 kg/ha. The treatment consisted of five levels of bacterial fertilizer *i.e.,* 0, 10, 15, 20 and 25 kg/ha. The experiment was laid out in five replicated Randomized Block Design. The bacterial fertilizer of *Bacillus circulans* increase the yield and quality of aniseed by stimulating plants absorption of N,P,K, Fe, Mg, Si and Mo and it contains about 1.5 to $2.0x10^8$ bacterial cells of *Bacillus circulans* /gram, total nitrogen 0.42%, total phosphorus 0.22%, total potassium 0.48%, organic matter 72.36% and nitrogen fixers population (free living) in Jensen's nitrogen- free medium $4X10^8$. The bacterial fertilizer applied in aniseed with soil mixing technology at the time of sowing. A recommended dose of 80 kg N+ 40 kg P_2O_5+40 kg K_2O/ha was applied to aniseed at planting. The crop was irrigated as and when required. Aniseed variety Pant Madhurika planted in rows at 45 cm apart using 4 kg seed/ ha. Plant to plant distance was maintained 30 cm apart after thinning. The crop was planted in the second week of October and harvested after complete maturity.

EXPERIMENTAL RESULTS AND ANALYSIS

Application of *Bacillus circulans* containing bacterial fertilizer @ 20 kg/ha or 2.00 lakh carror bacteria of *Bacillus circulans* /ha registered higher yield of aniseed by 15.10 q/ ha over control (11.40 q/ha) and lower installments during both the years of experimentation. The installment of *Bacillus circulans* containing bacterial fertilizer beyond 20 kg/ha confined to the further progress in the kernels production of aniseed (Table 1). These findings are in agreement with those reported by Singh (2007) in groundnut, Singh and Katiyar (2005) in vegetable pea and Singh *et al.* (2008) in aniseed. The kernels obtained from the bacterial fertilizer applied plots displayed marketable bright green colour over the produce of control plots.

The chewing taste of aniseed yielded from *Bacillus circulans* applied plots was better than the control plots product. The similar observations have also been reported by Singh (2006) in the quality of vegetable pea and Singh *et al.* (2008) in the quality of aniseed.

The minimum expenditure of Rs. 15,000/ha was incurred with 80 kg N + 40 kg P_2O_5 + 40kg K_2O + 0 kg bacterial fertilizer having *Bacillus circulans*/ ha while expenditure in variable dose of bacterial fertilizer with the integration of RDF varied from Rs. 15,600 at 10 kg dose of *Bacillus circulans* /ha to Rs. 16,500 at 25 kg bacterial fertilizer having *Bacillus circulans*/ha. As regards the net return, application of 20 kg bacterial fertilizer/ha in association of RDF proved to be highly remunerative (Rs. 1,34, 800 /ha) compared with other doses of bacterial fertilizer. Similarly, maximum benefit cost ratio was computed as 1:9.32 in RDF + 20 kg bacterial fertilizer having *Bacillus circulans*/ha. The investment of Rs 1.00 on application of bacterial fertilizer gave net response as Rs. 29.80 at 20 kg *Bacillus circulans* bacterial fertilizer/ha. These findings confirm the results of Singh *et al.* (2008).

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