

EFFECT OF N- FIXING BIOFERTILIZERS ON GROWTH, YIELD AND QUALITY OF CHILLI (*CAPSICUM ANNUUM* L.)

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ABSTRACT

To study the effect of inoculation of two nitrogen fixing bacteria culture viz., *Azotobacter* and *Azospirillum* with different levels of N (50%, 75% and 100%) in chilli cv. Arka Suphal, an experiment was conducted in the gangetic alluvial plains of West Bengal with sandy loam soil and neutral pH (6.8). Recommended dose of NPK @ 90:60:50 kg/ha and biofertilizer culture @ 500g/ha were applied. Results showed that the inoculation with *Azospirillum* + 75% N alongwith P & K recorded maximum fruit yield (10.25 t/ha), number of fruits/plant (80.20), fruit length (6.72 cm) and oleoresin content (19.80 %). All the growth characters like plant height (62.75 cm) and number of branches/plant (25.15) was found highest with *Azospirillum* + 100% N + PK, which were at par with *Azotobacter* + 100% N + PK. All the treatments were found superior over control (recommended dose of NPK only). Considering the cost:benefit ratio and yield of the crop, *Azospirillum* was considered better over *Azotobacter*.

INTRODUCTION

Among the spice crops of India Chilli (*Capsicum annuum* L.), a member of Solanaceae family is an important one. It is grown over an area of about 758 thousand ha with a production of 1234.10 thousand tonnes and productivity 1628 kg/ha in 2006-2007 (IISR, Calicut). It is an indispensable condiment of every home as used in the daily diet. Being introduced by Portuguese in 17th century, now the crop is grown all over India, especially in Andhra Pradesh, Karnataka, Tamil Nadu and Maharastra, account for 3/4 of the total area besides Madhya Pradesh, West Bengal, Punjab, Bihar and Rajasthan. Mineral nutrition is one of the main factors, which influences on growth, yield of chilli to a great extent. Continuous use of inorganic fertilizers has resulted in ecological imbalance with consequent ill effect on soil and environment. To maintain long term soil health and productivity there is a need for integrated nutrient management through manures and biofertilizers apart from costly chemical fertilizers for better yield of the crop (Mondal et al., 2003). Among the nitrogen fixing bacteria, *Azospirillum* is considered to be an associate symbiotic bacterium in root system and help fixing substantial amounts of nitrogen and several soil bacteria and fungi (Gaur and Ostwal, 1972). *Azotobacter*, not only provides nitrogen, but also synthesizes growth promoting hormones such as IAA and GA, *Azospirillum* also helps in plant growth and increases the yield of crops by improving root development, mineral uptake etc. The positive role of these biofertilizers has been recorded in many vegetables and spice crops by different scientists. Hence, the present experiment was undertaken to study their effect on growth, yield and quality of chilli (cv.

Arka Suphal).

MATERIALS AND METHODS

The investigation was carried out at Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, West Bengal during the period from 2008-09 and 2009-10. The soil of experimental field was sandy loam having organic carbon content 0.35%, available phosphorus 22.61kg/ha, available potassium 183.21kg/ha and pH of 6.8. The experiment was laid out in randomized block design with three replications and eight treatments combination. Inoculants of nitrogen fixing bacteria (*Azotobacter* and *Azospirillum*) were mixed with minimum quantity of water and individual seedlings were dipped for about 20 minutes and transplanted in the main field immediately. The quantities of each biofertilizers culture were used @ 500g/ha. The seedlings were transplanted at 50 cm x 50 cm spacing i.e. 12 seedlings/plot (2m x 1.5m). Recommended dose of NPK @ 90:60:50 kg/ha. The treatment combinations were: T₁- Recommended NPK only (control), T₂- Recommended NPK + FYM, T₃- *Azotobacter* + N_{50%} + Full PK, T₄- *Azospirillum* + N_{50%} + Full PK, T₅- *Azotobacter* + N_{75%} + Full PK, T₆- *Azospirillum* + N_{75%} + Full PK, T₇- *Azotobacter* + N_{100%} + Full PK, T₈- *Azospirillum* + N_{100%} + Full PK.

FYM was applied @15t/ha to all the treatments except control. All the fertilizers were applied at the time of land preparation and half of nitrogen was applied in two split doses i.e. 45 and 75 DAT. The observations on plant height, number of branches and fruit per plant, fruit length, fruit yield and

Table 1: Influence of *Azotobacter* and *Azospirillum* and nitrogen on chilli

Treatments	Plant height (cm)	No. of branches/plant	No. of fruits/ plant	Fruit length (cm)	Diameter of fruit (mm)	Fruit yield (t/ha)	Oleoresin content (%)	Cost benefit ratio
T ₁ : Recommended NPK only	54.85	21.17	71.85	5.85	9.05	8.10	18.05	1:2.27
T ₂ : Recommended NPK + FYM	56.13	22.50	74.15	6.05	9.41	8.95	18.42	1:2.50
T ₃ : <i>Azotobacter</i> + N _{50%} + Full PK	51.25	18.37	65.50	5.00	8.10	7.46	17.46	1:1.87
T ₄ : <i>Azospirillum</i> + N _{50%} + Full PK	53.05	20.87	68.35	5.12	8.55	7.65	17.67	1:1.98
T ₅ : <i>Azotobacter</i> + N _{75%} + Full PK	58.35	23.40	79.15	6.55	10.88	10.17	19.73	1:2.95
T ₆ : <i>Azospirillum</i> + N _{75%} + Full PK	59.62	23.95	80.20	6.72	10.94	10.25	19.80	1:3.02
T ₇ : <i>Azotobacter</i> + N _{100%} + Full PK	61.15	25.06	76.10	6.10	9.59	9.67	18.85	1:2.85
T ₈ : <i>Azospirillum</i> + N _{100%} + Full PK	62.75	25.15	77.95	6.38	10.15	9.85	19.12	1:2.90
C.D. at 0.5%	1.09	1.06	2.08	0.35	0.47	0.35	0.47	

oleoresin content were recorded. The experimental data were pooled over two growing seasons and analysed statistically as per method suggested by Gomez and Gomez (1984). The oleoresin content estimation was done by the procedure proposed by Sing *et al.*, 2001.

RESULTS AND DISCUSSION

The data on different parameters are presented in Table 1. The highest plant height (62.75 cm) and maximum number of branches (25.15) were found in the plants provided with *Azospirillum* + N_{100%} + PK which was at par with *Azotobacter* + N_{100%} + PK (61.15cm; 25.06) followed by *Azospirillum* + N_{75%} + PK (59.62cm; 23.95) and *Azotobacter* + N_{75%} + PK (58.35 cm ; 23.40). Whereas, number of fruits (80.20) per plant was recorded at treatment combination of *Azospirillum* + N_{75%} + PK which was at par with *Azotobacter* + N_{75%} + PK (79.15). Similar findings were also reported by Paramaguru and Natarajan (1993); Amirthalingam (1988); Dekha *et al.* (1996); Chandrappa *et al.* (2007) in chilli. It shows that the effect of both the bio-fertilizers has similar effect on growth characters of chilli, but varies with the changes in dose of nitrogen.

The yield of fruits was significantly influenced by the nitrogen fixing bacteria with different levels of Nitrogen. The maximum fruit yield was registered in the treatment *Azospirillum* + N_{75%} + PK (10.25 t/ha) and it was at par with *Azotobacter* + N_{75%} + PK (10.17 t/ha) followed by *Azospirillum* + N_{100%} + PK (9.85 t/ha). The minimum yield of fruits was found with *Azotobacter* + N_{50%} + PK (7.46 t/ha) and *Azospirillum* + N_{50%} + PK (7.65 t/ha). Maximum fruit length (6.72 cm) and fruit diameter (10.94 mm) were recorded by *Azospirillum* + N_{75%} + PK which were at par with *Azotobacter* + N_{75%} + PK (6.55 cm; 10.88 mm). The results are also in conformity of the findings of Veera Raghava Thatham *et al.* (1988), Paramaguru and Natarajan (1993), Dekha *et al.* (1996) and Chandrappa *et al.* (2007) who have also recorded increased yield of chilli due to biofertilizer application including NPK.

Plants provided with *Azospirillum* + N_{75%} + PK (19.80 %) and *Azotobacter* + N_{75%} + PK (19.03 %) were on par and recorded highest regarding oleoresin content, while the lowest oleoresin was found with *Azotobacter* + N_{50%} + PK (17.08 %). Similar variations in the quality of produce due to biofertilizers were also recorded by Sanoria (2001) in sugar beet, potato, tomato and Chandrappa *et al.* (2007) in chilli.

The highest value of cost:benefit ratio (1:3.02) was derived from the treatment combination of *Azospirillum* + N_{75%} + PK followed by *Azotobacter* + N_{75%} + PK (1:2.95), *Azospirillum*

+ N_{100%} + PK (1:2.90) and *Azotobacter* + N_{100%} + PK (1:2.85) while the least value of 1:1.87 was found in *Azotobacter* + N_{50%} + PK. The findings are in conformity with the results of the Veera Raghavathatham *et al.* (1988); Amirthalingam (1988) who recorded higher net returns due to inoculation of *Azospirillum* in chilli and Dekha *et al.* (1996) obtained maximum net return due to *Azospirillum* with cost:benefit ratio of 1:6.0 as against 1:4.8 in 70 kg N/ha alone.

Considering the above results of the experiment, it is concluded that application of the bio-fertilizer to the crop is beneficial for higher crop production and maintenance of soil health as well. Between the two bio-fertilizers, application of *Azospirillum* in combination with N_{75%} and full dose of P and K may give the highest return from cultivation of chilli in Gangetic Alluvial Plains of West Bengal.

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