Int.J.Curr.Microbiol.App.Sci (2017) *6*(9): 1292-1297

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 6 Number 9 (2017) pp. 1292-1297**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2017.609.155

Efficacy of Bio NP Liquid Biofertilizer in Chilli Nursery

H.N. Shelat[1], R.V. Vyas[1*], Y.K. Jhala[1], R.R. Acharya[2] and D.J. Parmar[3]

[1]Department of Agri. Microbiology, B. A. College of Agriculture, Anand Agricultural University, Anand-388110, Gujarat, India
[2]Main Vegetable Research Station, Anand Agricultural University, Anand-388110, Gujarat, India
[3]Department of Agri. Statistics, B. A. College of Agriculture, Anand Agricultural University, Anand-388110, Gujarat, India

**Corresponding author*

Keywords

NP liquid Biofertilizer, Chilli nursery.

Article Info

Accepted:
17 July 2017
Available Online:
10 September 2017

A B S T R A C T

To study the effect of inoculation of two nitrogen fixing bacteria culture *viz., Azotobacter* and *Azospirillum* and Phosphate solubilizing bacteria in chilli nursery, an experiment was conducted. Results showed that the inoculation with soil application of 75 % RDF NP along with seed treatment @ 5ml/kg OR soil application @ 1L/ha with Nitrogen fixer *Azospirillum lipoferum* ASA-1 together with Phosphate solubilizer *Bacillus coagulans* PBA 16, followed by foliar application @ 5ml/L water at 15 DAS had significant influence on number of transplantable seedlings and other seedling characters in chilli nursery as well as cost benefit ratio.

Introduction

Chilli (*Capsicum annum* L.) is the universal spice and is widely cultivated throughout temperate, tropical and subtropical countries. Being an important commercial crop, it finds diverse utilities as a spice, condiment, culinary supplement, medicine and vegetable. Chilli has two important commercial qualities, red color due to pigment capsanthin and biting pungency attributed by capsaicin. Indian chillies have been dominating international chilli market. Majority of chilli grown in India is cultivated in states such as Andhra Pradesh, Maharashtra, Karnataka, Gujarat, Tamil Nadu and Orissa. India contributes one-fourth of the total quantity of chilli exported in the world. Its production level hovers around 1.1 million tonnes annually. 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).Biofertilizers comprising of nitrogen fixing bacteria can fix atmospheric nitrogen whereas phosphate solubilizing organisms can solubilize phosphatic compounds and make phosphorous available to the plants. Among the nitrogen fixing bacteria, *Azospirillum* and *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 effect of nitrogen fixing and phosphate solubilizing bacteria on growth of seedlings of chilli *cv.* GVC 111 in nursery with the ultimate aim to provide healthy transplantable seedlings for raising the healthy crop.

Materials and Methods

The investigation was carried out at Department of agricultural Microbiology, B. A. College of Agriculture, Anand Agricultural University, Anand (Gujarat) during the period from *kharif*2011-14. The soil of experimental field was sandy loam having organic carbon content 0.25%, available phosphorus 25.60kg/ha, Nitrogen 0.025 % and neutral pH.The soil was well drained and retentive of moisture. It responded well to irrigation and manuring and was reasonably suitable for rice cultivation. The experiment was laid out in randomized block design with four replications and ten treatment combinations. The treatment combinations were: T_1- Recommended NPK only (control), T_2- 75 % Recommended NPK only, T_3- 75 % Recommended NPK + soil drenching of *Azotobacter* and PSB, T_4-75 % Recommended NPK + soil drenching of *Azospirillum* and PSB, T_5- 75 % Recommended NPK + seed coating of *Azotobacter* and PSB, T_6- 75 % Recommended NPK + seed coating of *Azospirillum* and PSB, T_7- 75 % Recommended NPK + soil drenching of *Azotobacter* and PSB+ foliar spray of *Azotobacter a*nd PSB at 15 DAS, T_8- 75 % Recommended NPK + soil drenching of *Azospirillum* and PSB+ foliar spray of *Azospirillum* and PSB at 15 DAS, T_9- 75 % Recommended NPK + seed coating of *Azotobacter* and PSB+ foliar spray of *Azotobacter* and PSB at 15 DAS, T_{10}-75 % Recommended NPK + seed coating of *Azospirillum* and PSB+ foliar spray of *Azospirillum* and PSB at 15 DAS. The nursery was raised in $1m^2$ beds. FYM was applied @$700g/m^2$ to all the plots.

The experiment was repeated for three consecutive years at main vegetable research station farm at AAU, Anand. All the fertilizers were applied at the time of land preparation. The observations on germination percentage, root length, shoot length root and shoot fresh as well as dry weight and number of transplantable seedlings were recorded. The experimental data were pooled over three growing seasons and two locations followed by statistical analysis as per method suggested by Gomez and Gomez (1984).The microbiological observations include microbial population in soil and phyllosphere.

Results and Discussion

Results of pooled analysis (Table 1) of 3 years revealed that treatment T_{10} receiving 75 % RDF NP along with *Azospirillum* + PSB seed treatment before sowing followed by foliar application at 15 DAS was found statistically the highest for germination (91%), root length (4.88), shoot length (11.83), root and shoot fresh weight (4.52 and 18.97 g) as well as dry weight of root (2.0 g)

shoot (6.07 g) and biomass (8.07 g) which was at par with 100% RDF NP.

Data analysis by FRBD as control vs. Rest (pooled over 3 years, Table 2) showed that among two biofertilizers treatments *Azospirillum* + PSB treatment was found significantly superior and *Azotobacter* + PSB treatment for root length and shoot fresh weight, whereas non-significant differences are observed for rest of the tested parameters. Among two methods of biofertilizers application i.e. seed treatment and soil drenching, seed treatment was found significantly superior over soil drenching of biofertilizers for all the parameters except root fresh and dry weight. Whereas foliar application of biofertilizers at 15DAI was found significantly superior over the treatments without foliar application for root and shoot length.

Economics presented in table 3 revealed that per 100 m^2highest gross income and BCR of Rs.18570and 2.26, respectively were obtained in T_{10} followed by T_1 (18300, 2.22).

Table.1 Growth parameters of Chilli as influenced by different treatments (Pooled over 3 years)

Tr No	Germination (%)	Root length (cm)	Shoot length (cm)	Fresh weight (g)		Dry weight (g)		
				Root	Shoot	Root	Shoot	Biomass
T_1	90^{ab}	4.46^{ab}	10.93^{ab}	4.38^{ab}	18.65^{a}	1.92^{ab}	5.63^{ab}	7.56^{ab}
T_2	81^{d}	3.22^{d}	8.27^{d}	2.40^{c}	12.71^{c}	0.61^{c}	3.42^{d}	3.99^{d}
T_3	84^{cd}	3.74^{cd}	9.61^{c}	3.16^{bc}	14.70^{bc}	1.13^{bc}	4.26^{cd}	5.39^{cd}
T_4	85^{bcd}	3.95^{bc}	10.13^{bc}	3.28^{abc}	15.35^{abc}	1.27^{abc}	4.50^{c}	5.77^{c}
T_5	85^{bcd}	4.00^{bc}	9.85^{c}	3.56^{abc}	16.32^{abc}	1.34^{abc}	4.69^{bc}	6.02^{bc}
T_6	87^{abc}	4.19^{bc}	10.31^{bc}	3.75^{ab}	17.40^{ab}	1.47^{ab}	4.89^{bc}	6.36^{bc}
T_7	86^{abcd}	4.28^{bc}	10.17^{bc}	3.97^{ab}	17.53^{ab}	1.58^{ab}	5.04^{abc}	6.62^{abc}
T_8	88^{abc}	4.46^{ab}	10.95^{ab}	4.01^{ab}	17.63^{ab}	1.71^{ab}	5.18^{abc}	6.89^{abc}
T_9	88^{abc}	4.45^{ab}	11.08^{ab}	4.29^{ab}	18.08^{ab}	1.89^{ab}	5.68^{ab}	7.58^{ab}
T_{10}	91^{a}	4.88^{a}	11.83^{a}	4.52^{a}	18.97^{a}	2.00^{a}	6.07^{a}	8.07^{a}
SEm ±	1.46	0.17	0.28	0.38	1.10	0.23	0.31	0.45
C.D. T at 5%	4.34	0.51	0.83	1.14	3.27	0.69	0.92	1.33
CD at Y x T 5%	3.04	0.54	1.01	0.74	1.97	0.26	0.53	0.58
C.V. %	2.49	9.27	6.97	14.13	8.37	12.69	7.66	6.50

Table.2 Growth parameters of Chilli as influenced by different treatments (Factorial RBD as Control Vs Rest)

Tr No	Germination (%)	Root length (cm)	Shoot length (cm)	Fresh weight (g)		Dry weight (g)		
				Root	Shoot	Root	Shoot	Biomass
EFFECT OF B (Biof)								
B1 (Azoto+PSB)	85.79	4.12	10.18	3.74	16.66	1.49	4.92	6.40
B2 (Azosp+PSB)	87.87	4.37	10.80	3.84	17.34	1.61	5.16	6.77
SEm ±	1.13	0.06	0.24	0.26	0.21	0.8	0.05	0.13
C.D. at 5%	NS	0.17	NS	NS	NS	NS	0.15	NS
EFFECT OF M (Methods of biof application)								
M1 (SOIL DRENCH)	85.79	4.11	10.21	3.60	16.30	1.42	4.74	6.17
M2 (SEED)	87.87	4.38	10.77	3.98	17.69	1.68	5.33	7.00
SEm ±	0.33	0.06	0.11	0.16	0.21	0.09	0.05	0.13
C.D. at 5%	0.93	0.17	0.31	NS	0.59	NS	0.15	0.79
EFFECT OF F (Foliar biof application)								
F1 (WITHOUT FOLIAR)	85.33	3.97	9.97	3.44	15.94	1.30	4.59	5.88
F2 (FOLIAR)	88.33	4.52	11.01	4.14	18.05	1.79	4.49	7.29
SEm ±	096	0.06	0.11	0.08	0.98	0.18	0.22	0.34
C.D. at 5%	NS	0.17	0.31	NS	NS	NS	NS	NS
YEAR EFFECT								
Y1 (2010-11)	79.48	4.37	11.54	0.84	7.39	0.46	2.48	2.93
Y2 (2012-13)	90.13	4.19	9.89	6.20	16.88	2.98	5.23	8.21
Y3 (2013-14)	90.89	4.17	10.04	4.33	26.71	1.21	7.41	8.62
SEm ±	0.40	0.07	0.14	0.10	0.26	0.03	0.07	0.06
C.D. at 5%	1.14	NS	0.39	0.85	0.73	0.09	0.18	0.19
SIGNIFICANT INTERACTION								
Y X B	1.62	-	-	-	-	0.13		0.27
Y X M	-	-	0.55	0.14	-	0.13		0.27
Y X F	1.62	-	-	0.40	1.04	0.13	0.26	0.27
M XF	-	-	-	-	-	-	0.21	0.23
CONT VS REST	0.98	0.18	0.33	0.24	0.64	0.09	0.17	0.19
Y X CON VS REST	3.04	NS	1.01	0.75	1.97	0.27	0.53	0.59
SEm ±	1.46	0.17	0.28	0.38	1.10	0.23	0.31	0.45
C.D. at 5%	4.34	0.51	0.83	1.14	3.27	0.69	0.92	1.33
C.V. %	2.49	9.27	6.97	14.13	8.37	12.69	7.66	6.50

Table.3 Economics as influenced by different treatments

Trt No	TP seedling /m^2	Per 100 m^2				
		TP seedlings	Gross Income	Cult. cost	Net benefit	BCR
	No.	No	Rs.	Rs.	Rs.	
T_1	610	61000	18300	8249	10051	**2.22**
T_2	506	50600	15180	8230	6950	1.84
T_3	537	53700	16110	8232	7879	1.96
T_4	547	54700	16410	8232	8179	1.99
T_5	565	56500	16950	8231	8719	2.06
T_6	575	57500	17250	8231	9019	2.10
T_7	582	58200	17460	8235	9225	2.12
T_8	590	59000	17700	8235	9465	2.15
T_9	599	59900	17970	8234	9736	**2.18**
T_{10}	619	61900	18570	8234	10336	**2.26**

Indian chillies have been dominating international chilli market. Majority of chilli grown in India is cultivated in states such as Andhra Pradesh, Maharashtra, Karnataka, Gujarat, Tamil Nadu and Orissa. India contributes one-fourth of the total quantity of chilli exported in the world. Its production level hovers around 1.1 million tonnes annually. Biofertilizers *Azotobacter, Azospirillum,* PSB contribute significantly in vegetables. Seed as well as foliar application of biofertilizers *Azotobacter, Azospirillum* and PSB are reported by Farhad *et al.,* (2012).The results of the present study clearly indicate the inoculation of the microbes were highly beneficial for enhancing the yield besides effecting a reduction in the cost of inorganic fertilizers and also significantly increases the soil fertility, soil beneficial microbes, and decreases the rate of diseases incidence.

From the foregoing results, it is concluded that treatment T_{10} wherein soil application of 75 % RDF NP along with seed treatment @ 5ml/kg OR soil application @ 1L/ha with Nitrogen fixer *A. lipoferum* ASA-1 together with Phosphate solubilizer *B. coagulans* PBA 16, followed by foliar application @ 5ml/L water at 15 DAS had significant influence on number of transplantable seedlings and other seedling characters in chilli nursery.

The positive influence of biofertilizers on various growth parameters observed in the present study were due to enhanced uptake of nutrients by the plants (Borea, 1991). *Azospirillum* aid in increased plant growth due to their nitrogen fixing capacity and also they are known to help in the synthesis of growth promoting substances like IAA and GA (Jackson and Brown, 1966). The present findings are also in good agreement with the observations of Gowda *et al.*, (2002) who observed the improved growth, yield and quality of chilli with 75% nitrogen, phosphorus plus 100% potassium in addition to the inoculation of biofertilizers.

Application of biofertilizers along with reduced levels of chemical fertilizers has beneficial effects compared to application of recommended NPK. PSB enhances P availability, it is also known to produced amino acids, vitamins and growth promoting substances like IAA and GA, which help in better growth of plants.

References

Borea, J.M., 1991. Vesicular arbuscularmycorrhizae as modifiers of soil fertility. *Adv. soil sci*. Springerverlag. New York, 15, 2-31.

Farhad, H., Ali, S., Hemmatollah, P., Seyyed, M. S., 2012. A comparison between foliar application and seed inoculation of biofertilizers on canola (*Brassica napus* L.) grown under waterlogged conditions. *Aust. J. Crop Sci.*, 6(10), 1435-1440.

Gomez, K.A., and Gomez, A. A., 1984. Statistical Procedures for Agricultural Research (2nd Ed.). A wiley Inter Science publication (John Wiley and Sons). New York. pp. 20-30.

Gowda, Kempe, K., Sajjan, M. and Sreeramm, B.S., 2002. Effect of biofertilizers with graded levels of nitrogen and phosphorus on growth, yield and quality of chillies (*Capsicum annuum*L.) cv. Byadagidabba. *PLACROSYM*, 15, 304-09.

Jackson, K.M., and Brown, M.E. 1966. Behaviour of *Azotobacter chroococcum* introduced in to the plant rhizospher. *Ann. Inst. Pasteur*. Paris. 3: 108-12.

Mondal, T., Ghanti, P., Mahato, B., Mondal, A. R. and Thapa, U., 2003. Effect of spacing and biofertilizer on yield and yield attributes of direct sown Chilli (*C. annuum* L. Cv. Bona Lanka). *Env. Eco*, 21, 712-15.

How to cite this article:

Shelat, H.N., R.V. Vyas, Y.K. Jhala, R.R. Acharya and Parmar, D.J. 2017. Efficacy of Bio NP Liquid Biofertilizer in Chilli Nursery. *Int.J.Curr.Microbiol.App.Sci.* 6(9): 1292-1297.
doi: https://doi.org/10.20546/ijcmas.2017.609.155