

Nutrient management of dill (*Anethum sowa* L.) through organic and inorganic management

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ABSTRACT

An experiment was conducted at HRS, Mondouri, BCKV, Nadia, West Bengal during rabi season of 2011-12 and 2012-13. Three levels of inorganic fertilizers i.e. 25, 50 and 75 per cent of recommended NPK (80:40:40 kg h⁻¹) and five biofertilizers namely *Azospirillum lipoferum*, *Azotobacter chroococcum*, phosphate solubilising bacteria (*Bacillus polymixa*), arbuscular mycorrhiza (*Glomus fasciculatum*) and potassic mobilizer (*Fraturia aruntea*) were included. PSB and AM were applied separately with *Azotobacter* and *Azospirillum* along with each level of inorganic and potassic mobilizer. The experiment was laid out in RBD with 3 replications. The sowing and harvesting were done during 1st week of November and last week of March respectively. Maximum plant height (164.34 cm), number of secondary branches plant⁻¹ (18.72), stalk length (26.15 cm), diameter of umbel (16.27 cm), number of umbel plant⁻¹ (124.67), number of flowers umbel⁻¹ (1229.67), seed yield plot⁻¹ (509.33 g per 5.4 m²) and projected yield (707.5 kg ha⁻¹) were recorded in NPK (50%) + *Azospirillum* + PSB + KM as compared to recommended dose of inorganic fertilizer (152.16 cm, 11.44, 23.74 cm, 14.20 cm, 86.56, 956.83, 395.50 g and 549.30 kg respectively). Combination of *Azospirillum* + PSB + KM along with 50 per cent RDF was best for higher yield of dill and there is a chance of saving of 50 per cent inorganic fertilizers.

Keywords : *Azospirillum*, *Azotobacter*, dill, potassium mobilize, PSB

Dill (*Anethum sowa* L.) commonly known as “sowa”, is an annual herb belonging to family Apiaceae. It is a commercial spice crop. Dill is of value for both its leaves and seeds. Young aromatic foliage is used in culinary. Dill seed with its pleasant aromatic and warming flavour is excellent for flavouring and seasoning. The seed also find its use as an anti-spasmodic, anti-flatulent, carminative, anti-inflammatory, anti-rheumatic and diuretic in pharmacological industry. The dill crop is mostly raised by farmers throughout the India, chiefly in Punjab, Uttar Pradesh, Gujarat, Maharashtra, Assam and West Bengal. Dill yields 6-8 per cent volatile oil on distillation and content high amount of carvone. Plant nutrition is one of the key factors influencing the growth and yield of crop plants. Continuous and indiscriminate use of chemical fertilizer has caused serious damage to the soil and ecology (Bhatt *et al.*, 2016). Application of biofertilizers provides effective implementation of biological mechanism of plant nutrition and growth promotion (Boddey and Dobereiner, 1995). The biofertilizers improve the sustainability of the soil and make it more productive (Asokan *et al.*, 2000). Biofertilizer enhances the productivity of the soil either by fixing atmospheric nitrogen or stimulating plant growth through synthesis of growth promoting substances. Therefore, judicious and proper use of organic and inorganic source is very much essential not only for obtaining higher yield and quality produce but also to maintain soil health and sustainability for longer period (Patil *et al.*, 2016).

Considering these, we decided to generate the information on effect of bio inoculants with graded levels of inorganic fertilizer on the growth and seed yield of newly introduced crop dill in the New Alluvial zone of West Bengal.

MATERIALS AND METHODS

The experiment was conducted at Horticulture Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, India during rabi season of 2011-12 and 2012-13. Three levels of inorganic fertilizers i.e. 25, 50 and 75 per cent of recommended NPK and five biofertilizers namely *Azospirillum lipoferum*, *Azotobacter chroococcum*, phosphate solubilising bacteria (*Bacillus polymixa*), arbuscular mycorrhiza (*Glomus fasciculatum*) and potassic mobilizer (*Fraturia aruntea*) were included in this experiment. PSB and AM were included separately with *Azotobacter* and *Azospirillum* along with each level of inorganic and potassic mobilizer. Altogether there are 13 treatments including inorganic NPK 100% (80:40:40 kg ha⁻¹) alone i.e. without biofertilizer. The experiment was laid out in RBD with 3 replications. The plot size was 3.0 x 1.8 m. The sowing and harvesting were done during 1st week of November and last week of March respectively. The spacing was maintained at 45x30 cm. The biofertilizers like *Azotobacter*, *Azospirillum*, PSB and VAM @ 10g plot⁻¹ and KM at 20g plot⁻¹ were applied in before sowing. The NPK fertilizers were applied @ 80:40:40 kg N, P₂O₅ and K₂O ha⁻¹. Half dose of N and

Table 1: Effect of organic and inorganic sources of nutrients on growth and yield of dill (Pooled data of two years)

Treatments	Plant height (cm)	No. of primary branches per plant	Number of secondary branches per plant	Stalk length (cm)	Diameter of umbel (cm)	No. of umbels per plant	No. of umbellate per umbel	No. of flowers per umbel	Seed yield per plot (g 5.4 m ⁻²)	Projected yield (kg ha ⁻¹)
100% NPK (80:40:40 kg ha ⁻¹)	152.16	8.61	11.44	23.74	14.20	86.56	31.00	956.83	395.50	549.3
N ₇₅ P ₇₅ K ₇₅ + Azot. + PSB + KM	154.08	8.72	14.44	23.31	13.32	91.00	31.28	1030.50	403.17	560.0
N ₇₅ P ₇₅ K ₇₅ + Azos. + PSB + KM	158.74	8.89	16.16	24.00	14.17	99.33	33.56	1097.67	433.17	601.7
N ₇₅ P ₇₅ K ₇₅ + Azot. + VAM + KM	153.53	8.72	16.39	24.40	14.27	91.56	31.94	1036.33	405.67	563.5
N ₇₅ P ₇₅ K ₇₅ + Azos. + VAM + KM	155.88	8.94	15.94	25.06	14.53	94.11	32.78	1063.17	414.83	576.2
N ₅₀ P ₅₀ K ₅₀ + Azot. + PSB + KM	161.94	10.28	18.55	26.02	15.99	123.17	36.83	1223.67	475.33	660.2
N ₅₀ P ₅₀ K ₅₀ + Azos. + PSB + KM	164.34	9.39	18.72	26.15	16.27	124.67	36.11	1229.67	509.33	707.5
N ₅₀ P ₅₀ K ₅₀ + Azot. + VAM + KM	158.96	9.06	17.05	25.39	14.55	102.44	35.00	1129.83	467.00	648.7
N ₅₀ P ₅₀ K ₅₀ + Azos. + VAM + KM	160.45	9.11	17.72	25.56	14.66	113.78	35.67	1159.33	474.50	659.1
N ₂₅ P ₂₅ K ₂₅ + Azot. + PSB + KM	143.51	7.5	7.78	23.31	9.89	62.89	26.89	750.33	260.50	361.8
N ₂₅ P ₂₅ K ₂₅ + Azos. + PSB + KM	150.86	8.44	12.55	21.11	12.74	84.67	31.61	917.67	373.67	519.0
N ₂₅ P ₂₅ K ₂₅ + Azot. + VAM + KM	147.80	8.17	9.06	21.24	11.83	77.17	28.56	852.17	279.50	388.2
N ₂₅ P ₂₅ K ₂₅ + Azos. + VAM + KM	149.37	7.67	10.06	22.33	13.19	82.11	30.33	901.67	355.83	494.3
S Em (±)	1.471	0.321	0.248	0.379	0.267	1.077	0.610	2.935	2.842	3.95
LSD (0.05)	4.183	0.913	0.704	1.078	0.760	3.062	1.735	8.345	8.081	11.22

(Azot.- Azotobacter, Azos.- Azospirillum, PSB- Phosphate solubilising bacteria, VAM- Vesicular arbuscular mycorrhiza KM- Potassium mobilizer)

full dose of P and K were applied as basal at 21 days after sowing and remaining half dose of N was applied as top dressing after 45 days of sowing. Seeds were soaked overnight and dried under shade. Seeds were sown in 1st week of November during both the year in flat beds with a spacing of 45x30 cm and thinning was done 3 weeks after germination to maintain the plant to plant distance. First irrigation was given immediately after planting. The subsequent irrigations were given at an interval of 15 days depending upon the soil moisture and weather conditions. Weeding was done manually. First weeding along with first thinning was done 20 days after sowing. Thereafter, weeding was done at an interval of 15 days. Plant is individually tied with stake by rope to protect from wind damage. Crop was harvested when brownish colour appear. All harvested plants were Sun dried for 3 days and then kept in shade for 2 days. Threshing was done by beating lightly with sticks, followed by winnowing and cleaning. Observations were recorded at 100 and 120 days after sowing respectively from five randomly selected plants per replication. Seed yield was taken on net plot basis and projected yield was calculated on the basis of yield per plot considering the 75 per cent area occupied by the crop (Anon, 1995).

RESULTS AND DISCUSSION

The pooled data presented in table 1 revealed significant variation among different treatments. The combination of biofertilizer along with graded levels of inorganic performed better over the recommended dose of fertilizers in most of the cases. Maximum plant height (164.34 cm), number of secondary branches plant⁻¹ (18.72), stalk length (26.15 cm), diameter of umbel (16.27 cm), number of umbel/plant (124.67), number of flowers/umbel (1229.67), seed yield/plot (509.33 g/5.4 m²) and projected yield (707.5 kg ha⁻¹) were recorded in NPK (50%) + *Azospirillum* + PSB + KM as compared to recommended dose of inorganic fertilizer (152.16 cm, 11.44, 23.74 cm, 14.20 cm, 86.56, 956.83, 395.50 g and 549.30 kg, respectively). The plants under NPK (50%) + *Azotobacter* + PSB + KM recorded maximum number of primary branches plant⁻¹ (10.28) and number of umbellets umbel⁻¹ (36.83) as compared to 8.61 and 31.00 in 100% RDF. The results clearly indicate that combination of *Azospirillum* + PSB + KM along with 50% RDF was best for higher yield of dill under alluvial plains of West Bengal and there is a chance of saving of 50% inorganic fertilizers. In respect of biofertilizers, *Azospirillum* and PSB combination showed better as compared to *Azotobacter* and VAM.

The combination of biofertilizers along with 75 and 50 per cent recommended dose of fertilizers proved effective as compared to 100% NPK (inorganic) alone. The possible reasons for increase dill yield might be

associated with better utilization of inorganic nutrients utilization, better root development, more photosynthetic area and possibly higher synthesis plant hormones (Mishustin and Naumova, 1962 and Pandey and Kumar, 1989). The experimental results indicated that *Azospirillum* and PSB were superior as compare to others. The better efficiency of *Azospirillum* and PSB was observed in chilli (Khan and Pariari, 2012) and garlic (Damse *et al.*, 2014). *Azospirillum* apart from its higher nitrogen fixing potential produces plant growth hormones also. The increasing activity of plant growth substances like gibberellic acid, indole acetic acid and dehydrozeatian in *Azospirillum* inoculated plants as noticed by Gunasekaran and Viassak (1986) might have responsible for increase vegetative growth. Sokhangoy *et al.* (2012) suggested that application of biofertilizers significantly increased plant height, number of spikes per plant, number of seeds per spike, number of seeds per plant and the weight of 1000 seeds in dill. Shaalan (2005) on dill also noted the same type of result. These findings are in accordance with the observations of Anitha *et al.* (2015) on fenugreek. Pariari *et al.* (2015) also showed that maximum seed yield (13.79q ha⁻¹) of fennel was obtained with 50 per cent nitrogen as urea in combination with *Azospirillum* in addition to phosphorus and potassium when the plants were spaced at 45x 30 cm .

Increased seed yield in biofertilizer treatments may be due to the improvement of yield components such as umbel number plant⁻¹, weight of 1000 seed weights and dry weight of plant. These results are in agreement with the investigation of Kumar *et al.* (2002) on *Coriandrum sativum* and Mahfouz and Sharaf Eldin (2007) on *Foeniculum vulgare*. In the present experiment, the increase in growth and yield may be attributed to better utilization of inorganic N, greater biological N fixation, higher synthesis of plant growth hormones and enhanced availability of P in the presence of biofertilizers.

REFERENCES

- Anitha, M., Swami, D.V and Salomi Suneetha, D.R. 2015. Seed yield and quality of fenugreek (*Trigonella foenum-graecum* L.) cv. Lam methi-2 as influenced by integrated nutrient management. *The Bioscan*. **10** : 103-06 .
- Anonymous 1995. *Annual Report*. All India Coordinated Research Project on Spices. Indian Institute of Spices Research, Calicut-12, Kerala ,pp.45
- Asokan, R. Mohandas, S. and Anand, L. 2000. Biofertilizers and bio pesticides for Horticultural crops. *Indian Hort.* **45** : 44-53.

- Bhatt, D., Desai, J.R. and Bhakta, D. 2016. Effect of bio inoculants on growth and yield of African marigold (*Tagetes erecta* L.) cv. Pusa Narangi gainda . *Bioscan* .**11** : 331-34.
- Boddey, R.M. and Dobereiner, J. 1995. Nitrogen fixation association with grasses and cereals: Recent progress and perspective for the future. *Fert. Res*, **42** : 242-50.
- Damse, D.N. Bhalekar, M.N. and Pawar, P.K. 2014. Effect of integrated nutrient management on growth and yield of garlic. *The Bioscan* .**9** : 1557-60.
- Gunasekaran, S. and K. Visassak 1986. Field inoculation of *Azospirillum brasilense* to *Cicholium intybus*(L). In. *Proc. Nat. Sem. on Microbial Ecology*. 23-26 January, 1986.
- Khan ,S. and Pariari, A .2012. Effect of N-fixing bio fertilizers on growth ,yield and quality of chilli (*Capsicum annuum* L.). *Bioscan* .**7** : 481-82.
- Kumar, S., Choudhary ,G.R. and Chaudhari, A.C. 2002. Effects of nitrogen and bio-fertilizers on the yield and quality of coriander (*Coriandrum sativum* L.). *Annals Agric. Res*, **23** : 634-37.
- Mahfouz, S.A. and Shamf Eldin, M.A. 2007. Effect of mineral vs. biofertilizer on growth, yield, and essential oil content of fennel (*Foeniculum vulgare* Mill.). *Int. Agrophysics*.**21** : 361-66.
- Mishustin, E. N. and Naumova 1962. Bacterial fertilizers their effectiveness and mechanism of action. *Micro Biologiya.*, **31** : 5443.
- Pariari ,A., Mukherjee, A. and Das , A. 2015 .Growth and yield of fennel (*Foeniculum vulgare* L.) as influenced by integrated nitrogen management and spacing . *J crop Weed* , **11**(2) : 90-93.
- Pandey, A. and Kumar, S. 1989. Potential of *Azotobacter* and *Azospirillum* as biofertilizers for upland agriculture. A review. *J Sci. and Industrial Res*. **48**: 134-44.
- Patil, Anand. G., Mangesh and Rajkumar., M. 2016. Integrated nutrient management in carrot (*Daucus carota* L.) under north eastern transitional track of Karnataka. *Bioscan* . **11** : 271-73.
- Shalan, M.N. 2005. Influence of biofertilizers and chicken manure on growth, yield and seeds quality of *Nigella sativa* L. plants. *Egyptian J. Agric. Res*. **83** : 811-28.
- Sokhangoy, S.H., Ansari K.H. and Eradatmand Asli. D. **2012**. Effect of biofertilizers on performance of dill (*Anethum graveolens*). *Iranian J Plant Physiol*. **2**: 547-52.