Internat. J. agric. Sci. Vol.2 No.2 July 2006 : (566-569)

Site specific nutrient management in European dill (*Anethum graveolens* L.) at subtropical belt of Uttaranchal

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ABSTRACT
The experiment on site specific nutrient management in European dill having 15 treatments was conducted at sub-tropical belt of Uttaranchal. It revealed that treatment T_3 having phosphorus @ 25 Kg ha^{-1} with other nutrients & micronutrients led to higher yield attributes and yield. The treatment T_5, T_6 & T_7 having decreasing levels of potassium caused a decrease in yield attributes & yield. Treatment T_{13} (vermicompost + recommended dose) had better yield attributes & yield compared to T_{12} & T_{14} having recommended dose and vermicompost alone respectively.

Key words : SSNM, European dill

INTRODUCTION

Existing fertilizer recommendations often consist of fixed rates and timings of fertilizer application for vast areas. Such recommendations assume the crops need for nutrients as constant among years and over large areas. But crop growth and crop need for supplemental nutrients can be strongly influenced by crop growing conditions, crop & soil management and climate which can vary greatly among fields, villages, seasons and years. Therefore, Site Specific Nutrient Management in European dill at sub-tropical belt of Uttaranchal would strive to enable the farmers to dynamically adjust fertilizer use to optimally fill the deficit between the nutrient needs of crop and the nutrient supply of naturally occurring indigenous sources.

European dill (*Anethum graveolens* L) commonly known as vilayati saunf in India is an annual, glabrous and aromatic herb belonging to the family umbelliferae. It is well known for its medicinal properties due to the presence of essential oil (2.5-3.0%) in the seed and 0.55 to 0.60% in whole plant. The essential oil and its constituents are used in pharmaceutical industries as they are considered to be stomachic, diuretic and anthelminthic. The emulsion of dill oil in water is considered to be carminative, anti-flatulent, anti-colic pain, anti-vomiting and anti-hiccups for infants and children (Randhawa and Singh, 1988). Dill oil is an important ingredient of gripe water preparation.

Since information on SSNM in medicinal and aromatic plants is very few, therefore, the present study gains more importance and was undertaken with the objective to record the response of site specific nutrient management on dry weight, number of branches / plant, yield attributes, yield and oil content of European dill an aromatic plant under subtropical conditions.

MATERIALS AND METHODS

The experiment on site specific nutrient management in European dill was carried out at Medicinal Plant Research and Development centre (M R D C) Haldi, Pantnagar during rabi season of 2003-04 and 2004-05.

The experimental site is situated in the Tarai region of Uttaranchal at 29^0 N latitude, 79^0 30'E longitude and of at altitude of 243.83m above mean sea level. The soil is classified as mollisol. The soil of the experimental field represents Haldi loam series which is the 23rd benchmark soil of India.

The field experiment conducted at MRDC had fifteen treatments replicated thrice in a randomized block design (RBD). The treatments were $N_{120}P_{75}K_{120}S_{30}B_5Fe_{40}Zn_{20}$ (**T_1**); $N_{120}P_{50}K_{120}S_{30}B_5Fe_{40}Zn_{20}$ (**T_2**); $N_{120}P_{25}K_{120}S_{30}B_5Fe_{40}Zn_{20}$ (**T_3**); $N_{120}P_0K_{120}S_{30}B_5Fe_{40}Zn_{20}$ (**T_4**); $N_{120}P_{75}K_{80}S_{30}B_5Fe_{40}Zn_{20}$ (**T_5**); $N_{120}P_{75}K_{40}S_{30}B_5Fe_{40}Zn_{20}$ (**T_6**); $N_{120}P_{75}K_0S_{30}B_5Fe_{40}Zn_{20}$ (**T_7**); $N_{120}P_{75}K_{120}S_{30}B_5Fe_{40}Zn_0$ (**T_8**); $N_{120}P_{75}K_{120}S_{30}B_5Fe_0Zn_{20}$ (**T_9**); $N_{120}P_{75}K_{120}S_{30}B_0Fe_{40}Zn_{20}$ (**T_{10}**); $N_{120}P_{75}K_{120}S_0B_5Fe_{40}Zn_{20}$ (**T_{11}**); GENERAL RECOMMENDATION ($N_{90}P_{50}K_{80}$) (**T_{12}**); VERMICOMPOST @ 5 t/ ha + RECOMMENDED DOSE (**T_{13}**); VERMICOMPOST @ 5 t/ ha (**T_{14}**) and CONTROL (No Fertilizer) (**T_{15}**).

Vermicompost @ 5 ton/ha was incorporated into the plots receiving vermicompost treatments. The sources of nutrients used were Urea, Diammonium phosphate and Muriate of potash for N, P and K respectively, whereas micronutrients Sulphur (S), Boron (B), Iron (Fe) and Zinc (Zn) were applied through Sulphur Powder, Boric Acid Powder (H_3BO_3), Iron Sulphate ($FeSO_4$) and Zinc chloride ($ZnCl_2$) respectively. The European dill crop was raised by direct seeding in 3-4 cm deep furrows at 45cm spacing and maintaining plant to plant distance of 20cm. The yield and yield attributes were calculated from harvest of net plot (4m x 3m) i.e., $12m^2$ area.

The observations taken were as follows: Dry weight of plants (g per m row length) at 90 DAS, 120 DAS & harvest stage; number of branches per plant at harvest; number of umbels per plant at harvest; seed weight per umbel at harvest; seed & straw yield (Kg/ha); Oil content (%) & oil yield (Kg/ha).

RESULTS AND DISCUSSION

Dry weight

Effect of different treatments on dry weight (g per metre row length) of European dill plants varied significantly at all the growth stages of crop during 2003-04 and 2004-05 (Table-1). At 90 DAS treatments T_4, T_5, & T_{13} had significantly higher dry weight and was at par with T_6 & T_9 during 2003-04 while during 2004-05 treatments T_7 & T_{12} caused significantly higher dry weight compared to other treatments and being at par with treatment T_3.

At 120 DAS, treatments T_5, T_9, T_{11} & T_{13} being at par with treatment T_6 were found to have significantly higher dry weight compared to remaining treatments during 2003-04 while during 2004-05 treatments T_2, T_7, T_9, T_{10} & T_{12} had significantly higher dry weight compared to remaining treatments and were at par with treatment T_{13}.

At harvest stage during 2003-04 treatment T_{13} recorded significantly higher dry weight while treatments T_6 and T_{12} were at par with it. During 2004-05, treatment T_3 recorded highest dry weight which was significantly higher over remaining treatments. However, treatment T_7 also had higher dry weight and treatments T_1, T_2, T_6, T_8 and T_9 were at par with it and being significantly higher over remaining treatments. These results are contrary to the results obtained by Halva and Puukka (1987) that at higher doses of N, P & K dry weight of dill increased.

The decreasing levels of phosphorus, potassium & micronutrients viz., Zinc, Iron, Boron & Sulphur did not affect the dry weight at any of the growth stages during both the years. Further, the

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highest dry weight observed in treatment T_{13} having vermicompost @ 5 ton / ha + recommended dose at 120 DAS, 2004-05 & harvest stage, 2003-04 clearly indicates that recommended dose + organic source caused higher dry weight as organic amendments release the nutrients slowly which are available to the plants at later stages of growth also it creates better soil environment for growth & development (Lazlo, 1979 & Halva and Puukka, 1987).

from K @ 80 Kg ha^{-1} to K=0 in treatments T_5, T_6 & T_7 during both years. The number of umbels per plant in treatments T_8, T_9, T_{10} & T_{11} did not record any trend or effect due to presence or absence of micronutrients, whereas, treatment T_{13} having vermicompost + recommended dose recorded higher number of umbels per plant as compared to treatments T_{12} and T_{14} having recommended dose & vermicompost alone respectively, during both years.

Table 1: Effect of different treatments on dry weight (g per m row length) of European Dill plants at various stages of crop growth during 2003-04 and 2004-05.

Treatment	Dry weight of plants (g per m row length)					
	90 DAS		120 DAS		Harvest Stage	
	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05
T_1 (P_{75})	32.00	66.00	103.33	235.00	152.67	390.66
T_2 (P_{50})	22.67	75.33	101.33	304.00	192.00	408.66
T_3 (P_{25})	22.00	92.00	73.33	255.33	184.00	494.66
T_4 (P_0)	34.00	57.33	92.00	200.00	142.00	314.66
T_5 (K_{80})	33.67	60.00	141.33	233.00	217.33	346.00
T_6 (K_{40})	37.33	50.00	158.67	130.00	221.33	378.00
T_7 (K_0)	26.67	79.33	99.33	362.00	201.33	420.66
T_8 (Zn_0)	18.67	38.00	120.67	233.00	154.67	412.33
T_9 (Fe_0)	37.33	77.33	155.33	377.00	212.67	412.66
T_{10} (B_0)	28.67	75.33	122.00	274.00	152.00	304.66
T_{11} (S_0)	28.00	52.00	146.00	251.00	185.33	310.00
T_{12} (RD)	31.33	82.66	100.67	314.00	236.00	305.33
T_{13} (VC+RD)	36.67	78.00	142.67	380.00	245.33	309.33
T_{14} (VC)	16.00	26.66	79.33	208.00	175.33	240.33
T_{15}	21.33	28.00	134.67	101.00	172.67	217.33
CD (5%)	3.97	13.79	17.36	18.98	25.68	49.76
CV(%)	8.36	13.19	8.79	24.08	8.09	8.87

RD -> Recommended Dose VC -> Vermicompost

Number of branches per plant

The effect of different treatments on number of branches per plant in European dill at harvest stage of crop growth table-2 was found to vary significantly during both the years. The comparison of T_1, T_2, T_3 & T_4 having decreasing levels of phosphorus while other nutrients being constant did not show any significant effect on number of branches per plant at harvest. Similarly, decreasing levels of K also did not have any significant effect on treatments T_5, T_6 & T_7 during both the years. The absence of micronutrients Zinc, Iron, Boron & Sulphur in treatments T_8, T_9, T_{10} & T_{11} also did not affect number of branches per plant as they were at par with each other during 2003-04 while during 2004-05 absence of Sulphur significantly lowered the number of branches per plant. The recommended dose alone (T_{12}) and its combination with vermicompost (T_{13}) resulted in more number of branches per plant as compared to vermicompost alone (T_{14}) during both the years. Singh *et al*., (1971) also reported similar results with application of nitrogen and phosphorus.

Yield attributes

The effect of different treatments on yield attributes of European dill at harvest stage during 2003-04 and 2004-05 varied significantly except seed weight / umbel 2004-05 (Table-2). The number of umbels / plant was recorded highest when phosphorus was applied @ 25 Kg ha^{-1} (T_3) as compared to T_1, T_2 & T_4 treatments during both years while decreasing levels of potassium also revealed a decreasing pattern

Seed weight / umbel was highest in treatment T_1 having P @ 75 Kg ha^{-1} and a decreasing trend was observed with decreasing level of Phosphorus during both the years. A similar decreasing trend was also observed in treatments T_5, T_6 & T_7 having Potassium @ 80, 40 & 0 Kg ha^{-1} respectively. However, the micronutrients did not record any significant effect on seed weight / umbel, whereas, vermicompost + recommended dose (T_{13}) recorded higher seed weight / umbel compared to recommended dose (T_{12}) & vermicompost (T_{14}) during both the years.

Oil Content

Though oil content of dill seeds varied non-significantly, the highest oil content was observed in treatment T_1 during both the years (Table-3). A decreasing trend in oil content was recorded with decrease in Phosphorus and Potassium levels during both the years. The vermicompost + recommended dose (T_{13}) recorded higher oil content as compared to recommended dose (T_{12}) & vermicompost (T_{14}) alone during both the years

Yield

Though, oil content was higher in treatment (T_1) but the oil yield (Fig.1 & Table-3) was significantly higher in treatment T_3 as it depends on seed yield (Fig.2 & Table-3) which was recorded to be significantly higher in treatment T_3. Also the number of umbels per plant was observed to be significantly higher in treatment T_3 (Table-2). Hence it

Table 2: Effect of different treatments on yield attributes of European Dill plants at harvest stage of crop during 2003-04 and 2004-05.

Treatment	No. Branches/plant		Yield attributes			
	At harvest		No. of umbel/plant		Seed wt./ umbel	
	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05
T_1 (P_{75})	29.44	66.00	14.22	16.00	3.78	5.64
T_2 (P_{50})	25.22	75.33	18.07	16.33	3.74	4.73
T_3 (P_{25})	25.44	92.00	19.55	20.00	3.24	4.40
T_4 (P_0)	23.11	57.33	16.14	16.33	3.20	4.22
T_5 (K_{80})	21.33	60.00	18.82	18.33	3.60	4.98
T_6 (K_{40})	24.89	50.00	18.81	17.66	3.24	4.96
T_7 (K_0)	27.33	79.33	16.96	16.33	3.20	4.46
T_8 (Zn_0)	25.11	88.00	17.77	15.66	3.38	4.74
T_9 (Fe_0)	22.89	77.33	16.29	18.33	3.78	5.50
T_{10} (B_0)	22.88	75.33	16.15	14.66	3.42	4.26
T_{11} (S_0)	26.77	52.00	18.81	12.33	3.29	4.49
T_{12} (RD)	24.55	72.66	14.52	12.66	3.23	4.65
T_{13} (VC+RD)	21.77	78.00	16.00	13.66	3.39	5.31
T_{14} (VC)	21.67	26.66	12.89	12.00	3.03	4.61
T_{15}	20.61	28.00	12.29	12.33	3.06	5.50
CD (5%)	4.11	7.35	2.16	2.5	0.46	NS
CV(%)	10.15	14.88	7.83	9.27	7.80	20.86

RD -> Recommended Dose VC -> Vermicompost

Table 3 : Effect of different treatments on oil content and yield of European Dill after harvest of crop during 2003-04 and 2004-05.

Treatment	Yield							
	Oil Content (%)		Oil Yield (Kg/ha)		Seed Yield (Kg/ha)		Straw Yield (Kg/ha)	
	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05
T_1 (P_{75})	1.60	1.89	16.54	27.78	1034.72	1470.99	1034.72	1470.99
T_2 (P_{50})	1.55	1.71	17.00	25.24	1097.22	1485.90	1097.22	1485.90
T_3 (P_{25})	1.51	1.68	17.92	30.77	1187.5	1843.62	1187.5	1843.62
T_4 (P_0)	1.46	1.63	16.51	20.70	1131.94	1270.45	1131.94	1270.45
T_5 (K_{80})	1.46	1.67	16.97	30.12	1163.19	1637.31	1163.19	1637.31
T_6 (K_{40})	1.46	1.84	16.71	26.12	1145.56	1537.39	1145.56	1537.39
T_7 (K_0)	1.44	1.71	15.94	25.03	1131.94	1499.45	1131.94	1499.45
T_8(Zn_0)	1.48	1.65	16.27	25.07	1090.28	1514.35	1090.28	1514.35
T_9 (Fe_0)	1.46	1.75	17.43	27.08	1179.78	1542.81	1179.78	1542.81
T_{10} (B_0)	1.53	1.60	16.15	23.74	1048.61	1517.06	1048.61	1517.06
T_{11} (S_0)	1.44	1.65	16.87	18.20	1163.19	1134.95	1163.19	1134.95
T_{12}(RD)	1.46	1.80	16.64	22.33	1136.11	1011.85	1136.11	1011.85
T_{13} (VC+RD)	1.55	1.88	18.28	15.94	1179.72	1188.34	1179.72	1188.34
T_{14} (VC)	1.44	1.72	12.42	17.51	856.11	927.63	856.11	927.63
T_{15}	1.42	1.62	12.50	11.12	874.31	687.80	874.31	687.80
CD(5 %)	NS	NS	2.50	7.17	104.26	593.69	104.26	593.69
CV (%)	7.04	8.78	9.18	18.48	5.70	26.53	5.70	26.53

RD -> Recommended Dose VC -> Vermicompost

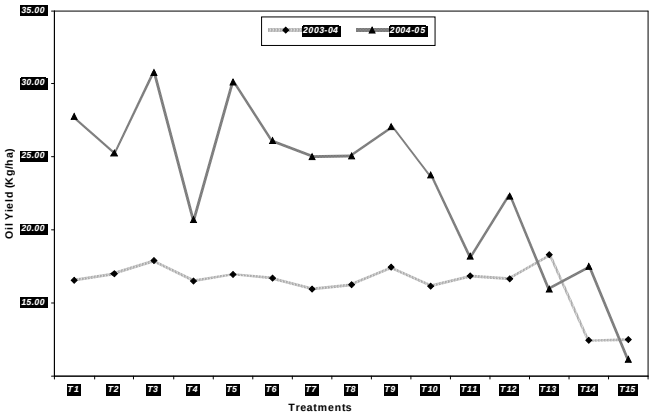

Fig. 1 : Effect of different treatments on oil yield of European dill 2003-04 and 2004-05.

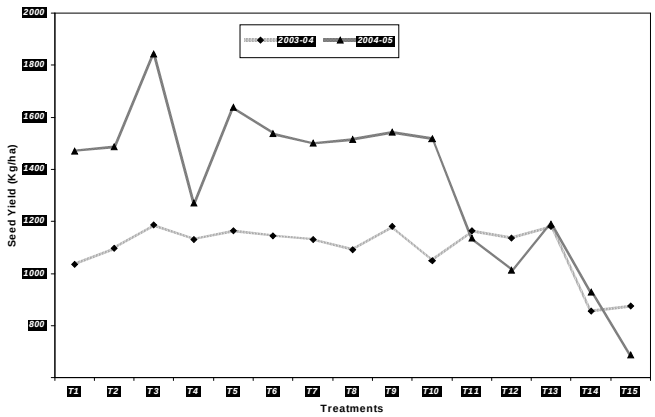

Fig. 2 : Effect of different treatments on seed yield of European dill 2003-04 and 2004-05.

can be deduced that Phosphorus applied @ 25 Kg ha^{-1} was found to be optimum for higher seed and oil yield. The oil and seed yield recorded similar trend of decrease with decreasing Potassium in treatments T_5, T_6 & T_7. Further, a comparison of recommended dose (T_{12}), vermicompost + recommended dose (T_{13}) and vermicompost (T_{14}) revealed that both oil and seed yield were higher in treatment T_{13} indicating a positive effect of organic source integrated with inorganic source. Randhawa *et al*., (1987) and Ativeer (1995) have also reported that European dill crop responds better to organic and integrated use of nutrient sources.

The straw yield (Table-3) was also significantly higher in treatment T_3. The treatments T_5, T_6 & T_7 revealed a decreasing trend with decreasing levels of Potassium , whereas, treatment T_{13} having vermicompost + recommended dose recorded higher straw yield compared to recommended dose (T_{12}) and vermicompost (T_{14}) alone during both the years.

Conclusion

Treatment T_3 having Phosphorus @ 25 Kg ha^{-1} with N, K and micronutrients resulted in higher growth, yield attributes and yield. Decreasing levels of Potassium decreased the yield attributes and yield. Vermicompost with recommended dose also resulted in higher yield attributes & yield compared to their application alone. However, the trend of effect of treatment during both the years of experimentation is more or less same but the overall performance of growth, yield attributes and yield were better in 2004-05 because of difference in time of sowing. The same has been reported by Gupta (1976) & Singh and Randhawa (1989) that dill could be sown in mid-October to get highest seed yield as delay in sowing causes reduction in growth and yield.

ACKNOWLEDGEMENT

The authors are grateful to Potash & Phosphate Institute of Canada for providing assistance to GBPUA&T for carrying out this investigation.

REFERENCES

Ativeer. (1995). Studies on the effect of row spacing and nitrogen levels in European dill *(Anethum graveolens* Linn.). M.Sc.Ag. (HortL) thesis submitted to G.B. Pant University of Agriculture and Technology, Pantnagar.

Gupta, R (1976). Studies in cultivation and improvement of dill *(Anethum graveolens)* in India, Part III Agronomic Studies. *Indian Perfumer,* **20 (A-B):** 85-89.

Halva, S. and Pukka, L. (1987). Studies on fertilization of dill *(Anethum graveolens* L.) and basil *(Ocimum basilicum* L.). I. Herb yield of dill and basil as affected by fertilization. *J. Agril.* Sci. *Finland,* **59(1):** 11-27.

Lazlo, H. (1979). Effect of nutrition supply on yield of dill *(Anethum graveolens* L) and its essential oil content. *Plant Medica,* **36(3):** 295-296.

Singh, R.S.; Singh, I.B. and Singh, C.P. (1971). Response of N & P on yield and essential oil content of dill in non-saline alkali soils. *Fertil. News,* **16(2) :** 48-49.

Randhawa, G.S.; Singh, A. and Mahey, R.H. (1987). Optimizing agronomic requirement for seed yield and quality of dill *(Anethum graveolens* L.) oil. *Acta Horticulturae,* **208 :** 61-68.

Randhawa, G.S. and Singh, A. (1988). Effect of agronomic practices on growth yield and nutrient uptake of dill *(Anethum graveolens). Indian Perfumer,* **32(4) :** 327-333.

Singh, Avtar and Randhawa, G. S. (1989). Plant population seed yield of dill (*Anethum graveolens* L.) as influenced by some agronomic factors.Haryana Journal of Agronomy **5(2):**110-114.

Received : February, 2006; Accepted : May, 2006

ISSN : 0973-4783

THE ASIAN JOURNAL OF EXPERIMENTAL CHEMISTRY

AN INTERNATIONAL JOURNAL

HIND AGRI-HORTICULTURAL SOCIETY