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Effect of Organic, Inorganic Source of Nutrients and *Azospirillum* on Yield and Quality of Turmeric (*Curcuma longa* L.)

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A B S T R A C T

To study the efficacy of *Azospirillum* in organic and integrated nutrient management with farmyard manure (FYM) and graded levels of nitrogenous fertilizer on turmeric, an experiment was undertaken at Uttar Banga Krishi Viswavidyalaya, Pundibari, during 2008-09, 2009-10 and 2010-11. The experiment was laid out in randomized block design with three replications. The results revealed that application of 75% recommended inorganic nitrogen with *Azospirillum* at 5kg/ha and FYM at 15 t/ha gave the highest yield of 26.29 t/ha as against 22.96 t/ha in the control of recommended dose of fertilizers at the rate of 80:80:120 kg N, P_2O_5 and K_2O per hectare. It was followed by the combined application of 50% recommended inorganic nitrogen with *Azospirillum* at 5 kg/ha and FYM at 15 t/ha with a yield of 25.8 t/ha and then 100% recommended in organic nitrogen with *Azospirillum* at 5kg/ha and FYM at 15 t/ha with a yield of 25.81 t/ha. The lowest yield of 18.36 t/ha was recorded in the treatment of sole application of FYM at 15 t/ha. The lowest dry recovery of 25.6% and curcumin content of 4.95% were recorded in control treatment with the application of only recommended dose fertilizers while the highest dry recovery of 26.87% was recorded with integrated nutrient management with application of 75% recommended inorganic nitrogen with *Azospirillum* at 5kg/ha and FYM at 15 t/ha and curcumin content of 5.11% was recorded in organic nutrient management with *Azospirillum* at 5 kg/ha and FYM at 30 t/ha.

Introduction

Turmeric (*Curcuma longa* L.) is an important spice crops in the world. India is the largest producer and exporter of this crop. It is extensively used in culinary application, cosmetic, pharmaceutical and dyeing industries. Indian turmeric has the high demand in the world market. In order to meet the export and internal demands of turmeric, production has to be increased. For its long crop duration, rhizomatous nature and high productivity it requires heavy input of fertilizers. Continuous uses of inorganic chemical fertilizers negatively affect the soil health and crop quality and pollute under ground water. To solve the above problem it is essential to reduce the indiscriminate use of inorganic chemical fertilizer and simultaneously use of different bio-fertilizers and organic nutrient sources. Mishra and Gopalkrishnan (2006) emphasized on organic production of turmeric keeping in view the increasing global demand for organic products. *Azospirillum* is known to fix a substantial amount of atmospheric nitrogen and supplies to the crop, enhances

the fertilizer use efficiency, soil fertility status and ensures partial saving of nitrogenous fertilizer. The ability of the *Azospirillum* to proliferate in the rhizosphere of crop suggests its ability to improve the nutrient availability to the plants and can supplement the expensive inorganic and organic fertilizers. Therefore, the present investigation was carried out to assess the efficacy of organic, inorganic source of nutrients and *Azospirillum* on yield and quality of turmeric in *terai* agro-climatic zone of West Bengal.

Materials and Methods

The experiment was conducted to assess the efficacy of organic, inorganic source of nutrients and *Azospirillum* on yield and quality of turmeric at Uttar Banga Krishi Viswavidyalaya, Pundibari during 2008-09, 2009-10 and 2010-11 with the variety Rajendra Sonia. The experiment was laid out in randomized bock design with three replications. The soil was sandy loam and medium fertile with *p*H 5.8, organic carbon 1.14 %, available nitrogen 189.28 kg/ha, available phosphorus 36.47 kg /ha and available potassium 75.78 kg/ha. Eight different treatments were studied in this experiment viz. T_1 :100% inorganic nitrogen + *Azospirillum* 10 kg/ha + FYM 10 t/ha, T_2 : 75% inorganic nitrogen + *Azospirillum* 10 kg/ha + FYM 10 t/ha, T_3 : 50% inorganic nitrogen + *Azospirillum* 10 kg/ha + FYM 10 t/ha, T_4 : *Azospirillum* 10 kg/ha + FYM 10 t/ha, T_5 : *Azospirillum* 10 kg/ha + FYM 20 t/ha, T_6 : 10 t/ha FYM, T_7 : 20 t/ha FYM and T_8 : recommended dose of inorganic nitrogen 80 kg/ha. Phosphorus 80 kg/ha and potash 120 kg/ha were applied uniformly to each treatment. Seed rhizomes were sown during 3rd week of April in plots of 3.0 m x 1.0 m size with spacing of 30 cm x 20 cm. Full dose of FYM, *Azospirillum*, phosphorus and 50 % potassium were applied as basal during the time of final land preparation. 50 % inorganic nitrogen was top dressed at 45 days and remaining 50 % inorganic nitrogen and 50 % potassium were top dressed at 90 days after planting. Mulching with paddy straw 20 t/ha and other intercultural operations were practiced uniformly to all treatments. Harvesting was done during the month of the February. Observations of fresh rhizome yield, dry recovery and curcumin content were recorded. Observations were recorded on ten plants selected randomly in each plot. Statistical analysis was carried out on method as suggested by Gomez and Gomez (1984). The economical parameters, like net monetary returns and benefit: cost ratios were worked out by using the prevailing market price of inputs and outputs in the locality.

Results and Discussion

Pooled data presented in table 1 revealed that the highest fresh rhizome yield per plant (236.70 g), per plot (9.90 kg) and per hector (26.29 ton) were obtained with the treatment of 75% inorganic nitrogen + *Azospirillum* 10 kg/ha + FYM 10 t/ha whereas the lowest fresh rhizome yield was recorded in the treatment of FYM 10 t/ha. Higher rhizome yield by the treatment T_2 might be due to higher availability of mineral nitrogen as well as higher organic carbon present in FYM. The lowest yield with 10 t/ha FYM may be due to shortage of readily available nitrogen at the initial active growth stage which might have delayed plant growth at early stages. Again presence of *Azospirillum* might have enhanced the activity of growth promoting substances, all have jointly promoted better nutrient up take and subsequently increased the rhizome yield of turmeric (Table 2).

Increased dose of FYM has increased the rhizome yield, dry recovery and curcumin content in rhizome.

Table.1 Effect of organic, inorganic source of nutrients and *Azospirillum* on yield of turmeric variety Rajendra Sonia

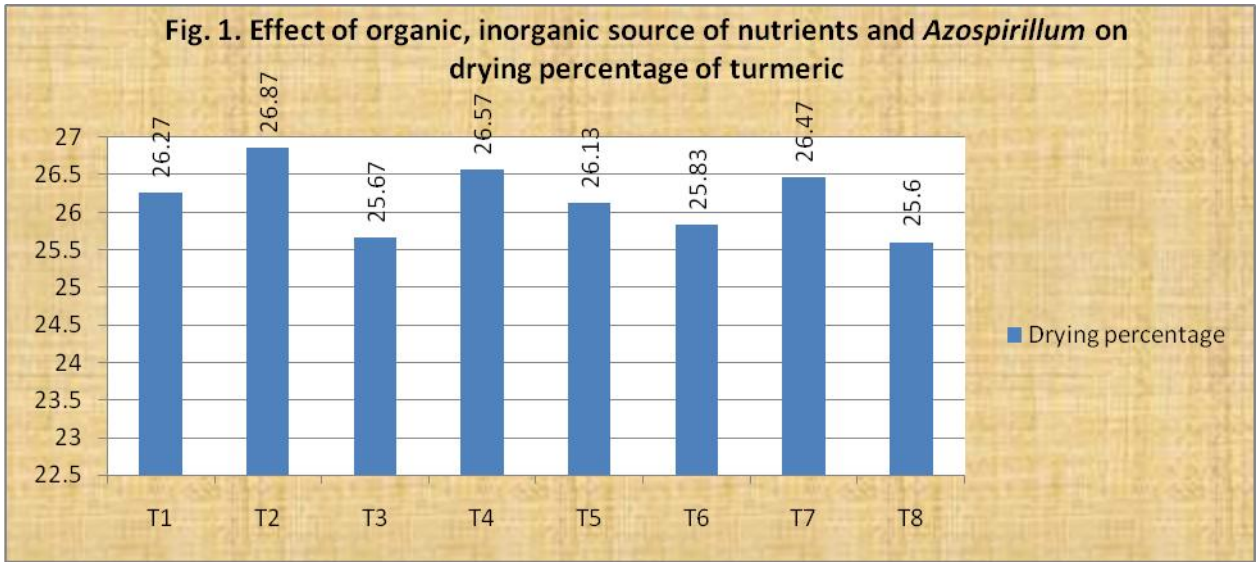
Treatment	Fresh Rhizome yield (g/plant)				Fresh Rhizome yield (kg /3 sq. m. plot)				Projected fresh Rhizome yield (t/ha)			
	2008-09	2009-10	2010-11	Mean	2008-09	2009-10	2010-11	Mean	2008-09	2009-10	2010-11	Mean
T_1 : 100% N+*Azospirillum* +FYM	159.2	164.9	346.2	223.43	9.2	9.5	9.63	9.44	24.5	25.8	27.14	25.81
T_2 : 75% N+ *Azospirillum* + FYM	174.3	173.5	362.3	236.70	9.8	9.8	10.1	9.90	26.1	24.4	28.36	26.29
T_3 : 50% N+ *Azospirillum* + FYM	153.7	155.4	322.0	210.37	9.5	9.2	9.60	9.43	25.3	23.1	26.84	25.8
T_4 : *Azospirillum* + FYM	129.8	122.6	236.7	163.03	7.0	7.8	7.87	7.56	18.7	19.4	23.32	20.47
T_5 : *Azospirillum* + 2 FYM	138.6	149.7	241.9	176.73	7.8	8.4	8.63	8.28	20.8	21.0	25.94	22.58
T_6 : FYM	115.4	116.2	216.2	149.37	6.4	7.0	7.07	6.82	17.1	17.5	20.48	18.36
T_7 : 2 FYM	130.1	133.8	225.2	163.03	7.6	8.1	8.03	7.91	20.3	20.3	22.25	20.95
T_8 :Recommended Fertilizer Dose	160.3	148.2	224.7	183.07	8.9	8.7	8.83	8.81	23.7	21.8	23.37	22.96
CD (5%)	24.4	14.1	20.9	-	1.3	0.9	0.4	-	2.6	2.1	1.15	-

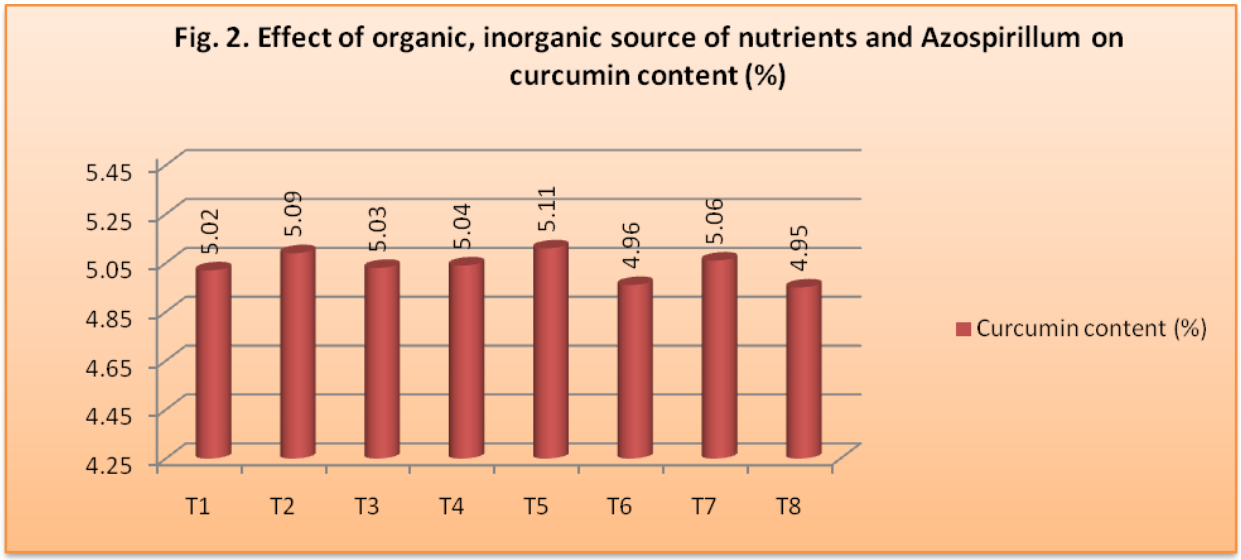
Recommended dose of fertilizer- 80: 80: 120 kg N, P_2O_5 and K_2O per hectare

Table.2 Effect of organic, inorganic source of nutrients and *Azospirillum* on quality of turmeric variety Rajendra Sonia

Treatment	Drying percentage				Curcumin content (%)			
	2008-09	2009-10	2010-11	Mean	2008-09	2009-10	2010-11	Mean
T_1 : 100% N+*Azospirillum* + FYM	26.1	26.8	25.9	26.27	4.98	5.01	5.06	5.02
T_2 : 75% N+ *Azospirillum* + FYM	26.5	27.5	26.6	26.87	5.05	5.11	5.12	5.09
T_3 : 50% N+ *Azospirillum* + FYM	25.6	25.9	25.5	25.67	5.04	5.01	5.03	5.03
T_4 : *Azospirillum* + FYM	26.2	27.1	26.4	26.57	5.01	5.05	5.05	5.04
T_5 : *Azospirillum* + 2 FYM	25.5	27.2	25.7	26.13	5.03	5.22	5.08	5.11
T_6 : FYM	25.9	26.3	25.3	25.83	4.85	5.01	5.02	4.96
T_7 : 2FYM	26.2	26.7	26.5	26.47	5.00	5.14	5.04	5.06
T_8 :Recommended Fertilizer Dose	25.8	26.2	24.8	25.60	4.82	5.02	5.02	4.95

Recommended dose of fertilizer- 80: 80: 120 kg N, P_2O_5 and K_2O per hectare





FYM combined with *Azospirillum* further, increased in rhizome yield, dry recovery and curcumin content in rhizome. *Azospirillum* and FYM in enhancing yield of ginger (Dash *et al.*, 2008), black pepper (Kandiannan *et al.*, 2000) and coriander (Malhotra *et al.*, 2006) were reported earlier.

Curcumin content which increases the turmeric quality was higher in all the treatments where *Azospirillum* were applied which shows curcumin enhancement with the use of biofertilizer. This is in conformation with the earlier works Velmurgan and Chezhian (2005) and Upadhayay and Mishra (1999) on turmeric.

The combined application of 75% inorganic nitrogen + *Azospirillum* 10 kg/ha + FYM 10 t/ha recorded the maximum curcumin content (5.09%) and drying recovery (26.87%) compared to rest of the treatments (Fig. 1). This may be due to the availability of more quantity of nutrients which could have promoted curcumin synthesis in plant synthesis (Fig. 2).

In conclusion, considering all the above aspects together two types of recommendations can be given for two situations. In one situation where 75% inorganic nitrogen + *Azospirillum* 10 kg/ha + FYM 10 t/ha can be recommended to obtain the highest fresh turmeric yield with high curcumin content. Combination of all organic, inorganic nitrogen and nitrogenous biofertilizer saved use of 25% inorganic nitrogen. In case of 100% organic farming, farmers need to use Azospirillum 10 kg/ha and double dose of FYM i. e., 20 t/ha to obtain sustainable yield.

References

Dash, D.K., Mishra, N.C. and Sahoo, B.K. 2008. Influence of nitrogen, *Azospirillum* sp and farn yard manure on yield, rhizome rot and quality of ginger (*Zingiber officinale* Rosc.). *J. Spices Aromatic Crops*, 15:115-117.

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

Kandiannam, K., Sivarman, K., Anandaraj, M. and Krishnamurthy, K.S. 2000. Growth and nutrient content of black pepper (*Piper nigrum* L.) cuttings as influenced by inoculation with biofertilizers. *J. Spices, Aromatic Crops*, 9:145-147.

Malhotra, S.K., Vashishtha, B.B. and Appa Rao, V.V. 2006. Influence of nitrogen, Azospirillum sp and farn yard manure on growth, yield and incidence of stem gall disease in coriander (*Coriendrum sativum* L.). *J. Spices Aromatic Crops*, 15: 115-117.

Mishra, N.C. and Gopalkrishnan, P.C. 2006. Production of organic turmeric and ginger in Orissa. *Spice India*, 19(4): 21-23.

Upadhayay, D.C. and Mishra, R.S. 1999. Nutritional study of turmeric Cv. Roma under agroclimatic condition of eastern Uttar Pradesh. *Progressive Hort*., 31(3/4): 214-218.

Velmurgan, M. and Chezhian, N. 2005. Effect of organic manure and biofertilizers on growth, yield and quality of turmeric Cv. BSR-2. *South Indian Hort*., 53(1-6): 392-396.

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