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Effect of Organic Farming on Yield and Quality of Spices in India

Impact des pratiques d'agriculture biologique sur le rendement et la qualité des épices en Inde

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Abstract: Green house and field experiments conducted with improved varieties of spices (black pepper, ginger and turmeric), on the effect of organic farming on soil quality, spices productivity and quality attributes of spices together with factors controlling the levels of organic matter in soils. Application of organics improve the organic matter status, water holding and cation exchange capacity of soils. For growing bush pepper in pots (holding 10 Kg. soil), application of 30 g. neem cake or 15 g. groundnut cake at bi-monthly intervals was comparable to application of NPK @ 1, 0.5 and 2 g. per pot with regard to nutrient availability in soil, yield response and uptake of nutrients. For ginger, application of neem cake @ 2.5 ton/ha. or groundnut cake @ 1 T/ha. , NPK @ 75, 50, 25 Kg./ha. enhanced oil and oleoresin production. Rhizome rot disease incidents of ginger was restricted to 5% due to neem cake application, in turmeric , application of neem cake @ 2 T/ha. or groundnut cake @ 1 T/ha. was on par with NPK application at 60, 50, 120 Kg./ha. with regard to yield and production of curcumin, though NPK fertilizers gave the highest B/C ratio. The organic matter was correlated with water holding and cation exchange capacity of the soil. The soil physical, chemical and biological properties were enhanced by the integrated nutrient management with the use of organic and inorganic fertilizers with least hazard to environment.

INTRODUCTION:

Spices are grown in India about 2.3 million ha. with an annual production 2.5 million tonnes worth US \$ 1700 million. During 1996-97 India exported 2.2 lakh tonnes of spices worth US \$ 330 million. Organic farming assumes significant globally towards production of quality produce. The demand for organically grown spices is increasing in the global market. Information is lacking on the effect of organic fertilizers on the production of quality spices. Hence the present investigation was taken up.

MATERIALS AND METHODS:

Field and green house experiments were conducted during 1992-97 using improved varieties of black pepper (*piper nigrum* L), ginger (*zigiber officianale*) and turmeric (*curcuma loga* L) using different organic fertilizers (cow dung, goat, sheep and pig manures), organic cakes (neem-azaridacta indica, cotton-gospium sp., mustard-brassica sp. groundnut-aracheis hypogea and gingell-sesamum indicum). Organics were applied equivalent to recommended N with balance of P and K as chemical fertilizers for each crop, i.e. NPK @ 1:0.5:2 g./pot at bi-monthly interval for bush black pepper (Sadanandan & Hamza, 1996 a), NPK @ 60:50:120 Kg./ha. for turmeric (Sadanandan & Hamza, 1996 b) and @ 75:50:50 Kg./ha. for ginger (Sadanandan & Hamza, 1997). The studies were carried out in the typical spices growing red and laterite soil with pH 5.5, organic matter 3.1%, Bray-p 12 ppm., exchangeable K 161 ppm. under the humid tropics with an annual rainfall ranging from 3000-4000 mm. in 115-130 rainy days and temperature between 22 to 36°C. with relative humidity ranging from 35 to 89%. Investigations were carried out on transformation and availability of nutrients in the soil (Jackson 1967, Hesse 1971), yield response and quality (ASTA 1968) of different spices. Residual effect due to application of organic fertilizer was also studied. Data were subjected to statistical analysis (Anon 1985).

RESULTS AND DISCUSSIONS:

a. Soil physico-chemical characteristics: Availability of soil nutrients was significantly increased due to application of organics. With regard to oil cakes, groundnut cake was significantly superior followed by neem cake and other cakes (Table.1). The organic cakes increased moisture retention capacity and reduced the bulk density of soil even for the subsequencies. Among organic manures used, poultry and goat manures were on par in increasing nutrient availability in soil (Table 2).

Table. 1: Soil availability of nutrients as affected by application of organic and inorganic fertilizers.

Treatments	Org. M pH	Bray %	P	Exchangeable			DTPA
				K	Ca	Mg.	Zn.
Check	6.1	3.07	24	58	477	58	1.2
Neem cake	6.0	3.40	25	71	715	69	2.8 C
Cotton cake	5.9	3.30	36	70	617	75	2.9
Mustard cake	5.8	3.47	37	70	725	83	2.4
Groundnut cake	5.7	3.65	40	85	770	78	2.9
Gingily cake	5.7	3.44	33	79	689	69	2.7
MPK Fertilizer	5.8	3.45	25	80	819	73	2.5
CD at 5%	0.09	0.13	6	13	102	11	0.35

b. Yield and quality: Black pepper: Among the organic manures, poultry manure, followed by goat manure was superior than FYM with regard to yield and quality parameters like oil, oleoresin and piperine production (Table.2). Among the organic amendments groundnut cake followed by neem cake were superior as evidenced the highest production of the spikes and yield (Table 3).

Table 2: Effect of organic manure on soil availability of nutrients and yield of black pepper:

Treatments	Avail	Bray	Exchangeable			Yield*
	N	P	K	Ca	Mg	
	ppm			g/pot		
Check	64	14	50	575	41	95
Goat Manure	105	40	270	586	71	190
Poultry Manure	102	42	281	580	78	196
Pig Manure	95	29	251	627	82	171
FYM	90	27	206	603	74	169
NPK Fertilizers	83	30	96	594	45	215
CD at 5%	5.7	4.6	11	48	7	35

*Mean of five years Ginger and Turmeric: Regarding rhizome yield of turmeric, among the treatments, NPK fertilizers gave highest yield (4884 Kg/ha.) which was on par with neem cake, groundnut cake and cotton cake application (Table. 3). With regard to rhizome yield of ginger, groundnut cake applied plot registered maximum (4077 Kg./ha.) followed by neem cake, cotton cake and gingelly cake which were on par. This was followed by NPK fertilizers, FYM and mustard cake (Table 3). Under well drained soil conditions, organic materials which give benefits often exceed the contribution of fertilizers (Hsieh and Hsieh 1990)

Table 3: Yield of spice crops as affected by organic fertilizers

Treatments	Yield		
	Black pepper (gm/pot)	Turmeric Kg/ha.	Ginger Kg/ha.
Check	54	2893	2787
FYM	160	4194	3599
NPK Fertilizers	183	4884	3724
Neem Cake	192	4818	3946
Cotton cake	163	4623	3887
Mustard Cake	113	4295	3413
Groundnut Cake	200	4809	4077
Gingely Cake	171	4224	3851
CD at 5%	17	376	228

With regard to curcumin recovery on turmeric, among the treatments, neem cake gave highest (287kg ha-1) followed by cotton and groundnut cakes which were on par. Neem cake applied plot registered highest oleoresin production (320 kg ha-1) in ginger followed groundnut cake which were on par. This was followed by FYM, cotton cake, gingily cake and NPK fertilizers (Table 4).

Treatments	Black pepper Oleoresin (%)	Yield	
		Turmeric Curcumin (Kg ha-1)	Ginger Oleoresin (kg ha-1)
Check	11.2	169	209
FYM	11.2	250	281
NPK fertilizers	11.5	268	231
Neem cake	11.3	287	320
Cotton cake	10.9	284	278
Mustard cake	10.9	243	242
Groundnut cake	11.2	277	302
Gingily cake	11.4	249	266
CD at 5%	NS	16	23

Conclusion

Globally there is an increasing awareness on the better utility of organics, as compared to inorganics, in crop production. Since the array of spice crops studied in this investigation have very great culinary importance, their nutritional requirements assume importance as clearly evidenced by the positive influence the organics had on availability of soil nutrients, water retention, bulk density etc. Results of this investigation are a clear pointer to the positive prospects of organic spice farming in India.

In practical terms, for adopting some of the components of organic farming priority should be given the following :

- * Absorption of organic by-products into spices growing system, to minimize the use of chemicals, builds up long term fertility and contribute to conservation of environment
- * Use of biological alternative and intergrated disease and pest management
- * Integrated bio-farming technology development

Keywords : amendement, manure, organic fertilizer, organic farming, black pepper, ginger, turmeric and spice oils

Mots clés : amendement, fumier, fumure organique, agriculture biologique, poivrier, gingembre, épice