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Effect of Different Management Practices on the Control of Rhizome Rot, Yield and Best Economic Return of Ginger

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Abstract

A field trial was conducted at the Spices Research Center, BARI, Shibganj, Bogra during 2009-10 to study the effect of different management practices to control of rhizome rot and best economic return on the growth and yield of ginger. Ginger cv. BARI Ada-1 was planted 1st week of April. Six treatments were used viz., C_1 (solarization of soil), C_2 (burning of soil by rice straw), C_3 (burning of soil by saw dust), C_4 (neem cake), C_5 (mustard oil cake) and C_6 (control). The treatment was arranged in Randomize Complete Block Design using with three replications. The results reveled that C_4 (neem cake) showed early emergence, highest plant height, number of leaves plant^{-1}, number of tillers plant^{-1} with maximum weight of primary rhizome and secondary rhizome, highest dry matter % and weight of old mother rhizome tha^{-1}. The highest yield of rhizome (18.02 tha^{-1}) and best benefit cost ratio (2.25) was also recorded in the C_4 (neem cake). From the results, it can be concluded that C_4 (neem cake 2.0 tha^{-1}) treatment produced higher yield and best benefit cost ratio for ginger cultivation in northern region of Bangladesh.

Key words: *Rhizome rot, Management practices, Yield, Economic return and growth*

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1. Introduction

Ginger (*Zingiber officinale* Rosc.) is an important spice crop in Bangladesh. In Bangladesh about 16,000 hectares of land under cultivation against the requirement of 2, 41,000 metric tons per annum and production of 16,000 metric tons [1]. The food, perfumery, and pharmacy industries are the main outlets which it is used. Locally, it is used for medicinal purposes and can also be ground and blended with other local spices for use in soups and porridge [3]. It is extensively grown during kharif season. The farmers of Bangladesh have been following their practices for ginger cultivation since long back as a result of which the crop used to exhibit low yield per unit area of land. Beside the varietal factor, the rhizome rot control and yield of ginger can be increased with the adoption of improved management practices, such as solarization of soil, burning of soil by rice straw, burning of soil by saw dust, neem cake and mustard oil cake. Control of rhizome rot is a serious impediment to ginger production. Farmers of Bangladesh have no clear idea about appropriate control measure of rhizome rot. Inspite of its serious effect on production, very few research works have so far been done on its incidence, nature of damage and management aspects. But no effective measures have yet been reported. Due to this reason, the farmers generally fail to harvest healthy crop. Considering above mentioned situation, the present research program was undertaken with control of rhizome rot and best economic return for ginger cultivation.

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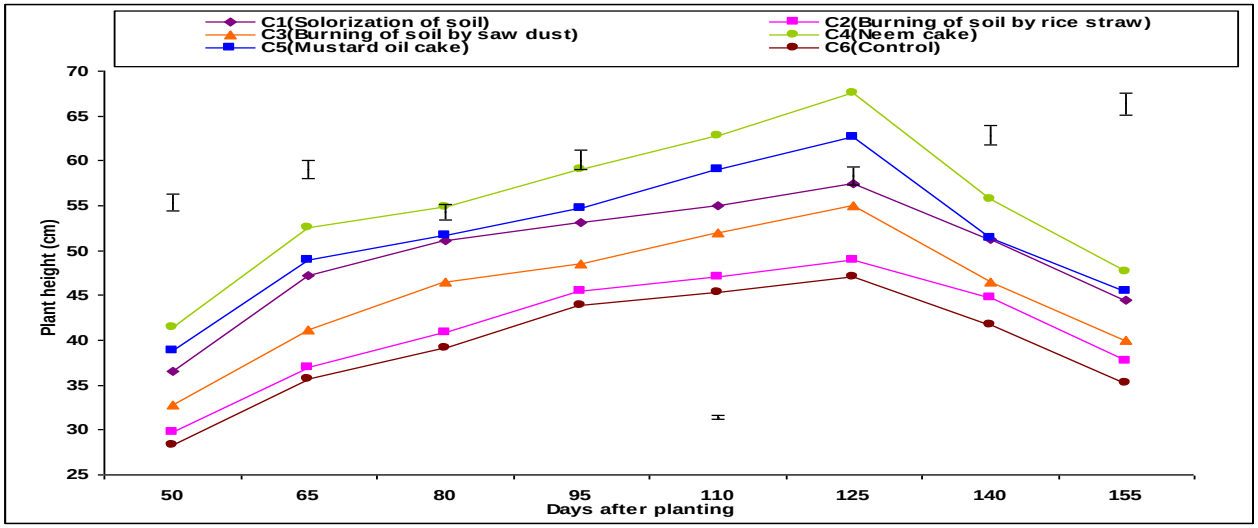
2. Materials and Methods

The experiment was undertaken in the farm of the Spices Research Centre, BARI, Bogra, during the period from April 2009 to January 2010. It has sub-tropical climate with an average annual rainfall of 237.13 mm. The soil is Tista polal tract, having a P^H of 5.8-6.6. The field experiment was laid out in a Randomize Complete Block Design with three replications. Each plot measuring 4.0m long and 1.5m broad was prepared for each treatment. Transparent polyethene sheet was placed on the plot and soil was placed on the edges of each polyethene sheet to secure covering. The polyethene sheet was placed on the 1st February and removed after 4 weeks [6]. Burning of soil by rice straw and sawdust (rice straw 0.75 kgm^{-2} and sawdust 1.0 kgm^{-2}). Before planting soil was burn by rice straw and sawdust. Soil was covered by mulching materials maintains 7.5cm thickness followed by burning. The entire quantity of neem cake (2.0 t ha^{-1}) and mustard oil cake also (2.0 t ha^{-1}) were applied at the time of land preparation [4]. Healthy ginger rhizome BARI Ada-1 variety was used and weight 40g per seed rhizome for planting material. Planting was done at 1st April. A uniform application of Cowdung, Urea, TSP, MP and Gypsum at 5 tons, 304, 267, 233 and 111 kg ha^{-1} respectively was also made to all experiment area and other cultural operations was given according to the requirements of the crop. Total cowdung was applied at the time of general land preparation and the entire quantity of TSP, Gypsum and half of MP was applied during final land preparation. The half of the Urea was applied 50 days after planting and the remaining MP and Urea was applied in two equal splits 80 and 110 days after planting. Earthing up was done at 60, 90 and 110 days after planting. The crop was grown under rainfed condition, because farmers are generally ginger produced without irrigation. The data on different growth parameters was recorded from 10 selected plants 15 days' interval randomly each plot at 50, 65, 80, 110, 125, 140 and 155 days after planting. Yield and yield contributing characters was collected at harvesting time. The collected data was analyzed statistically and adjusted with least significance (LSD) at 5% and 1% level of probability.

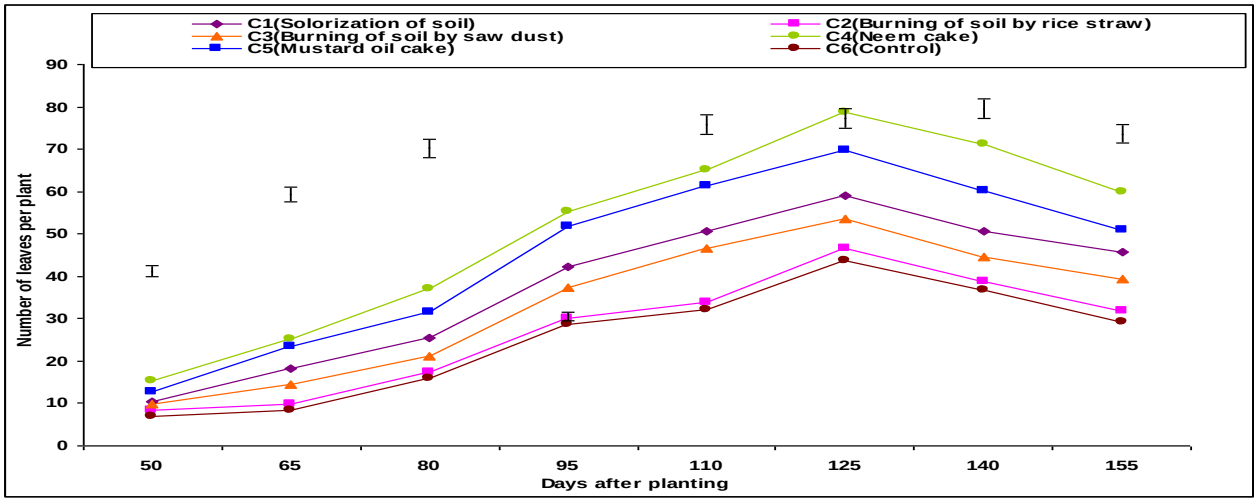
3. Results and Discussion

Planting time significantly influenced growth and yield contributing characters of ginger (Table1). C_6 (control) took the maximum days (37) to complete 80% emergence while it was minimum days (29) in the C_4 (neem cake). It might be due to the fact that the neem cake improved the organic matter status, water holding and cation exchange capacities of soil than other treatments which enhanced the rapid emergence of seed rhizomes. Plant height was counted at an interval of 15 days viz., 50, 65, 80, 95, 110, 125, 140 and 155 DAP (Fig. 1). The highest plant height (67.57cm) was obtained from the C_4 (neem cake) and the lowest (47.00cm) was obtained from the C_6 (control) at 125 DAP. The probable causes of seed rhizomes emerged earlier and showed vigorous and rapid growth that enhanced the tallest plant. This finding agrees with the finding by Kamal (2009). The number of leaves $plant^{-1}$ was counted at an interval of 15 days viz., 50, 65, 80, 95, 110, 125, 140 and 155 DAP. The highest number of leaves (78.80) was recorded from C_4 (neem cake) and the lowest number of leaves $plant^{-1}$ (43.67) from the C_6 (control) at 125 DAP (Fig. 2). It might be due to application of neem cake increased nutrient availability and improved soil physical condition that enhanced the maximum number of leaves $plant^{-1}$. The number of leaves $plant^{-1}$ was declined due to senescence of older leaves. Number of tillers $plant^{-1}$ was counted different growth stage at an interval of 15 days at 50, 65, 80, 95, 110, 125, 140 and 155 DAP. The maximum numbers (12.83) of tillers $plant^{-1}$ was obtained from the C_4 (neem cake) while the minimum (7.66) was obtained from the C_6 (control) at 125 DAP (Fig. 3). The neem cake treatment produced more tillers $plant^{-1}$ which might be due to the prevailing congenial atmosphere for vegetative growth. The production of primary and secondary rhizome also significantly influenced by C_4 (neem cake) treatment showed the highest yield $plant^{-1}$ (278.60g and 76.24g) of primary and secondary rhizome $plant^{-1}$ respectively and the lowest yield (199.80g and 45.60g) of primary and secondary rhizome $plant^{-1}$ was obtained from C_6 (control) (Table 1). It might be due to neem cake enhanced vigorous plant growth, more nutrient availability and more accumulation of photosynthates which promoted maximum weight of primary rhizomes $plant^{-1}$. The C_4 (neem cake) showed non-significant effect on the dry matter content of rhizomes. The maximum dry matter of rhizomes was found (23.5%) from C_4 (neem cake) treatment and the minimum (19.00%) from the C_6 (control) treatment (Table 1).



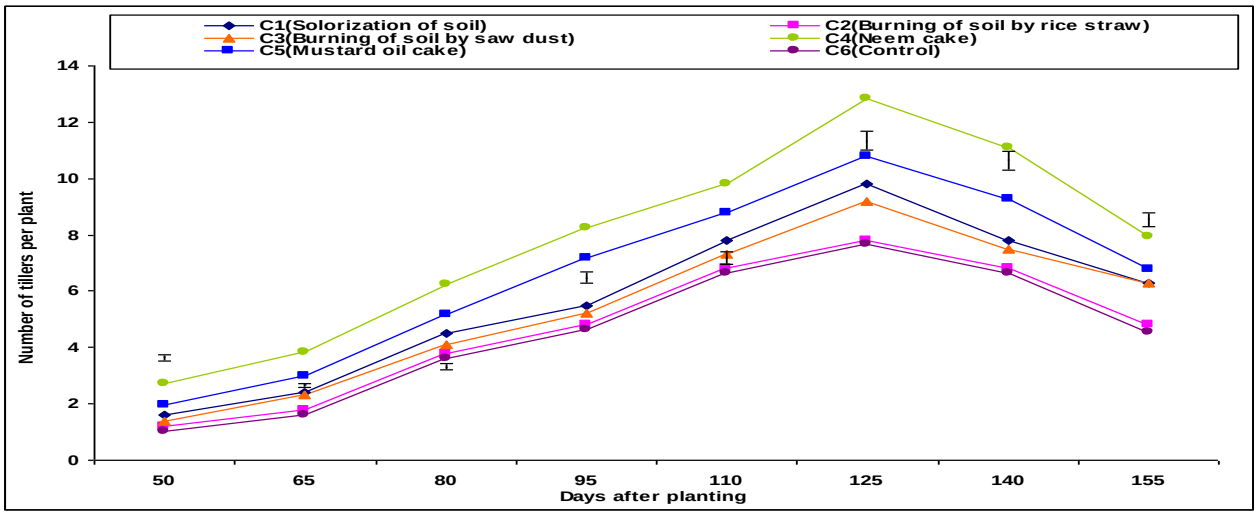
[Note: Vertical bars represent LSD at 5% level of probability]

Fig. 1. Main effects of different management practices on plant height of ginger



[Note: Vertical bars represent LSD at 5% level of probability]

Fig. 2. Main effects of different management practices on number of leaves plant^{-1} of ginger



[Note: Vertical bars represent LSD at 5% level of probability]

Fig. 3. Main effects of different management practices on number of tillers plant^{-1} of ginger

It might be due to resultant effect of maximum development of rhizomes. The weight of old mother rhizomes was taken 80 days after planting and the data were analyzed. Significant variation was found due to different management practices. The highest weight of the old mother rhizome (2.86 t ha^{-1}) was obtained from C_4 (neem cake) and the lowest (1.96 t ha^{-1}) from the C_6 (control) treatment (Table1). Significant difference in yield $plant^{-1}$, yield $plot^{-1}$ and yield tha^{-1} was noticed by the C_4 (neem cake) (Table 1). The maximum yield 169.00g $plant^{-1}$, 10.81 kg $plot^{-1}$ and18.02 t ha^{-1} was found from C_4 (neem cake) and the minimum 88.50 g $plant^{-1}$, 5.66 kg $plot^{-1}$ and 9.44 t ha^{-1} recorded from C_6 (control) treatment respectively (Table 1). It might be due to neem cake produced higher number of leaves $plant^{-1}$, tillers $plant^{-1}$, higher nutrient uptake, improved organic matter, and higher photosynthesis which ultimately resulted in maximum rhizomes yield. Similar findings also reported by Kamal (2009) and Sadanandan and Hamza (1998).

Table 1. Main effects of different management practices on the growth, yield contributing characters and rhizome damage (%) of ginger

Treatment	Emergence (%) at DAP				wt. of primary rhizome $plant^{-1}$ (g)	wt. of secondary rhizome $plant^{-1}$ (g)	Weight of old mother rhizome (tha^{-1})	Rhizome yield $plant^{-1}$ (g)	Rhizome yield $plot^{-1}$ (kg)	Rhizome yield (tha^{-1})	Dry matter (%)	Rhizome damage (%)
	20	40	60	80								
C_1	24	27	29	32	60.63	253.40	2.70	144.50	9.25	15.41	21.60	2.41
C_2	26	30	34	35	50.10	225.40	2.50	113.00	7.23	12.05	20.00	5.28
C_3	24	29	31	34	56.00	232.00	2.61	136.80	8.76	14.60	21.00	2.43
C_4	19	25	27	29	76.24	278.60	2.86	169.00	10.81	18.02	23.50	1.78
C_5	22	26	28	30	64.40	262.30	2.80	155.60	9.96	16.60	22.00	1.99
C_6	30	33	36	37	45.60	199.80	1.96	88.50	5.66	9.44	19.00	7.41
LSD (0.05)	4.5	4.8	6.2	4.8	7.31	7.66	0.71	9.13	3.24	4.48	6.22	1.61
LSD (0.01)	6.4	6.9	8.8	6.8	10.40	10.89	1.02	12.99	4.61	6.37	8.85	2.29
Level of significance	**	**	**	**	**	**	*	**	**	**	NS	**
CV%	10	9.4	11	8.0	6.84	1.74	15.21	3.73	20.69	17.16	16.15	24.97

C1=Solorization of soil, C2= Burning of soil by rice straw, C3= Burning of soil by sow dust, C4= Neem cake, C5= Mustard oil cake, C6= Control
* =Significant at 0.05% level of probability, ** =Significant at 0.01% level of probability, NS = Not Significant, DAP= Days after planting

3.1 Rhizome damage percentage

The results indicated that significant effect on control of rhizome rot damage on ginger. Among the treatments, the lowest rhizome rot damage (1.78%) was found from the C_4 treatment (neem cake) followed by C_5 (mustard oil cake) treatment (1.99%) and C_3 (burning of soil by saw dust) treatment (2.43%). Inversely, the highest incidence of rhizome rot was found in the C_6 (control) treatment (7.41%) followed by C_2 (burning of soil by rice straw) treatment (5.28%) and C_1 (solarization of soil) treatment (2.41%) (Table 1).

3.2 Economic analysis

An attempt was made to examine the cost and return in ginger production. The total cost of production was highest (TK.496951 ha^{-1}) in the C_4 treatment (neem cake) while the lowest cost of production (TK.426451 ha^{-1}) was recorded from the C_6 (control) treatment (Table 2). The highest gross return (TK.1119800 ha^{-1}) was obtained from the C_4 treatment (neem cake) while the lowest gross return (TK.607400 ha^{-1}) was obtained from the C_6 treatment (control) (Table 2). The highest gross return was obtained due to C_4 (neem cake) treatment produced maximum rhizomes yield. The results presented in the (Table 2) show that the net return was comparatively higher (TK.622849 ha^{-1}) with the C_4 treatment (neem cake) and the lowest net return (TK.180949 ha^{-1}) was recorded from the C_6 (control). All treatment combinations gave positive net return.

Table 2. Economic analysis of ginger production per hectare as influenced by rhizome rot with different management practices

Treatment combination	Yield of old mother rhizomes (tha^{-1})	Fresh rhizomes yield (tha^{-1})	Gross return (Tk. ha^{-1})	Total cost of production (Tk. ha^{-1})	Net return (Tk. ha^{-1})	Benefit cost ratio (BCR)
C_1=Solorization of soil	2.70	15.41	966050	448482	517568	2.15
C_2= Burning of soil by rice straw	2.54	12.05	777050	455826	321224	1.70
C_3= Burning of soil by sow dust	2.61	14.60	920450	473451	446999	1.94
C_4= Neem cake	2.86	18.02	1119800	496951	622849	2.25
C_5= Mustard oil cake	2.80	16.60	1039000	478151	560849	2.17
C_6= Control	1.96	9.44	607400	426451	180949	1.42

Old mother rhizomes sales @ Tk. 45/kg, fresh harvested rhizomes sales @ Tk. 55/k

3.3 Benefit-Cost ratio

Among the treatments it was found that the highest benefit-cost ratio of 2.25 was recorded from the C_4 treatment (neem cake) followed by 2.17 from C_5 treatment (mustard oil cake). The lowest benefit-cost ratio of 1.42 was recorded from the C_6 treatment (control). Considering the economic point of view, it can be concluded that the application of two-ton neem cake per hectare (C_4 treatment) would be suitable for the production of ginger under Bogra, Bangladesh condition.

4. Conclusion

From the results, it can be concluded that C_4 treatment (neem cake 2.0 t ha^{-1}) is the best and profitable for ginger cultivation in northern region of Bangladesh.

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