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Research Note

EFFECT OF NITROGEN AND MULCHES ON THE YIELD AND ECONOMICS OF CHINESE CABBAGE (*Brassica campestris* var. *Pekinensis*)

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ABSTRACT

An experiment was conducted at the Horticulture Farm of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during the period from October 2005 to December 2005 to study the effect of nitrogen and mulching on the growth and yield of Chinese cabbage. The highest fresh weight of head (2.43 kg) was recorded in N_3 (250 kg N/ha) on the other hand the lowest fresh weight (1.57 kg) was recorded in N_0 (control). The maximum thickness and diameter of head (25.18 and 17.06 cm) of Chinese cabbage was recorded in N_3 (250 kg N/ha) and the minimum thickness and diameter of head (18.98 and 14.21 cm) was recorded in N_0 (control). The highest marketable yield per hectare of Chinese cabbage (120.06 ton) was recorded in N_3 (250 kg N/ha) and the lowest yield (67.90 ton) was recorded in N_0 (control). The highest fresh weight of head/plant of Chinese cabbage (2.44kg) was recorded in M_1 (black polythene) and the lowest fresh weight of head (1.72kg) was recorded in M_0 (control). The maximum thickness and diameter of head of Chinese cabbage (24.74 and 16.86 cm) was recorded in M_1 (black polythene) and the minimum thickness and diameter of head (18.98 and 15.10 cm) was recorded in M_0 (Control). The highest marketable yield per hectare of Chinese cabbage (123.27 ton) was recorded in M_1 (black polythene) and the lowest yield (76.51 ton) was recorded in M_0 (control). In and every case maximum growth and yield contributing characters and yield was observed in N_3M_1 (250 kg N + black polythene) and the reverse result was recorded in N_0M_0 (control). In the combination of different doses of nitrogenous fertilizer and different mulches highest benefit cost ratio (3.56) was attained from the treatment combination N_3M_1 (250 kg N + black polythene) and the lowest (1.22) was obtained in N_0M_0 (Control).

Key words : Mulches, Nitrogen, Chinese cabbage

INTRODUCTION

Chinese cabbage (*Brassica campestris* var. *Pekinensis*) is an important leafy, herbaceous vegetable crop originated in China and belonging to the family Cruciferae (Rashid, 1999). To attaining considerable production and quality yield for any crop management practices including the availability of essential nutrient components is necessary. Chinese

cabbage thrives well in a fertile, clay loam soil because it requires considerable amounts of nutrients to sustain rapid growth in short time. A large amount of nitrogen is required for the growth of the non-heading leaves and the differentiation of inner head leaves (Opena *et al*., 1988). Nitrogen has profound effect on the number of folded leaves and progressively increases the marketable yield (Obreza and Vavrina, 1993). Nitrogen had the largest effect on yield and quality of Chinese cabbage (Liu *et al*., 1999). An adequate supply of nitrogen is essential for vegetative growth, head formation and desirable yield (Yoshizawa *et al*., 1981). Excessive nitrogen application causes physiological disorder that appears small black spots on the midribs of head leaves (Obreza and Vavrina, 1993). Mulching play an important role to reduce the evaporation loss of soil and in this way, it maintain sufficient moisture in the soil. On the other hand, Chinese cabbage is a cool seasoned herbaceous leafy crop and it favors temperature range from 15-20^{o}C. Mulching also provide, acceptable temperature to the soil by protecting sunlight. In most of the time irrigation expenses increase the cost of production resulting in unprofitable production of Chinese cabbage and make growers frustrated. Mulching offers tremendous potential for increased crop production through its noticeable effect on the soil environment which ensures proper growth and yield of crop (Lal, 1989). The efficient use of nitrogen from the economic point of view can be achieved by soil moisture management through mulching. The efficiency of nitrogen fertilizer use was normally 30% under Bangladesh context, which was increased upto 53% with special arrangement through mulching (Sweeney *et al*., 1987). Combined effect of nitrogen and mulching has also increasing growth and yield of Chinese cabbage (Russo *et al*., 1997).

MATERIALS AND METHODS

The experiment was conducted at the Horticulture Farm of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during the period from October 2005 to December 2005 to study the effect of nitrogen and mulching on the growth and yield of Chinese cabbage. The experiment consisted of two factors. Factor A: Levels of nitrogen (4 levels) i.e. N_0 (No N fertilizer/Control), N_1 (160 kg/ha), N_2 (200 kg/ha) and N_3 (250 kg/ha); Factor B: Mulches (4 levels) i.e. M_0 (No mulch), M_1 (black polythene), M_2 (saw dust) and M_3 (water hyacinth). The experiment was laid out in the two factors Randomized Complete Block Design (RCBD) with three replications. The significance of the difference among the treatment was estimated by the least significant difference (LSD) test at 5% level of probability (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Nitrogen fertilizer showed a gradually increasing trend of fresh weight of head of Chinese cabbage (Table 1). The highest fresh weight of head per plant (2.43kg) was recorded in N_3 (250 kg N/ha) which was closely followed (2.26 and 2.18kg, respectively) by N_2 (200 kg N/ha) and N_1 (160 kg N/ha). On the other hand the lowest fresh weight of head (1.57 kg) was recorded from N_0 (control). Fresh weight of head per plant at different mulches showed significant differences. The highest fresh weight of head per plant of

Chinese cabbage (2.44kg) was recorded in M_1 (Black polythene) which was closely followed (2.28kg) by M_2 (saw dust). On the other hand the lowest fresh weight of head (1.72 kg) was recorded in M_0 (control), which was closely followed (2.01 kg) by M_3 (water hyacinth). Interaction effect between nitrogen fertilizers and mulches showed no statistically significant difference in consideration with fresh weight of head per plant in Chinese cabbage. The highest fresh weight of head per plant (2.88 kg) was recorded in N_3M_1 (Table 2) and the lowest fresh weight of head per plant (1.26 kg) was recorded in N_0M_0.

Table 1. Effect of different level of nitrogen doses and mulching on yield contributing characters of Chinese cabbage

Nitrogen × Mulching	Fresh weight of head (kg)	Thickness of head (cm)	Diameter of head (cm)	Marketable yield (t/ha)
N_0	1.57^{c}	18.98^{c}	14.21^{b}	67.90^{c}
N_1	2.18^{ab}	22.75^{b}	16.08^{a}	107.09^{b}
N_2	2.26^{b}	24.23^{a}	16.55^{a}	110.65^{b}
N_3	2.43^{b}	25.18^{a}	17.06^{a}	120.06^{a}
LSD (0.05)	0.156	1.233	1.049	5.342
Level of significance	0.01	0.01	0.01	0.01
M_0	1.72^{d}	20.81^{c}	15.10^{c}	76.51^{d}
M_1	2.44^{a}	24.74^{a}	16.86^{a}	123.27^{a}
M_2	2.28^{b}	23.27^{b}	16.40^{ab}	111.01^{b}
M_3	2.01^{c}	22.31^{b}	15.54^{bc}	94.91^{c}
LSD (0.05)	0.156	1.233	1.049	5.342
Level of significance	0.01	0.01	0.01	0.01
CV (%)	8.82	6.49	7.88	6.32

Head thickness of Chinese cabbage illustrated statistically significant distinction in relation to the different doses of nitrogen applied in the present trial. The thickest head (25.18 cm) of Chinese cabbage was recorded from N_3 which was statistically similar to N_2 (24.23 cm). The thinnest head of Chinese cabbage (18.98 cm) was recorded in N_0 (Table 1) which was closely followed by N_1 (22.75 cm). Different mulches showed a statistically significant disparity in consideration with thickness of head of Chinese cabbage. The thickest head of Chinese cabbage (24.74 cm) was recorded in M_1 which was closely followed by M_2 and M_3 (23.27 cm and 22.31 cm, respectively) and the thinnest head of Chinese cabbage (18.98 cm) was recorded in the plot with M_0 (Table 1). In consideration the interaction effect between nitrogen fertilizer and mulches the thickness of head of Chinese cabbage showed a statistically significant variation. The thickest head of Chinese cabbage (26.51 cm) was recorded in N_3M_1 and the thinnest head (13.95 cm) was recorded in N_0M_0 (Table 2).

Table 2. Interaction effect of different level of nitrogen doses and mulching on yield contributing characters of Chinese cabbage

Nitrogen × Mulching	Fresh weight of head (kg)	Thickness of head (cm)	Diameter of head (cm)	Marketable yield (t/ha)
N_0M_0	1.26	13.95^{h}	12.55	45.60
N_0M_1	1.70	21.54^{efg}	15.70	81.21
N_0M_2	1.68	20.31^{g}	14.99	76.23
N_0M_3	1.64	20.11^{g}	13.61	68.56
N_1M_0	1.80	22.90^{bcdefg}	15.63	81.62
N_1M_1	2.53	24.60^{abcd}	16.74	131.80
N_1M_2	2.40	22.30^{cdefg}	16.60	116.11
N_1M_3	1.98	21.21^{fg}	15.33	98.83
N_2M_0	1.84	22.04^{defg}	15.90	86.47
N_2M_1	2.64	26.32^{a}	17.20	135.41
N_2M_2	2.48	24.89^{abc}	16.76	118.90
N_2M_3	2.10	23.68^{abcdef}	16.35	101.82
N_3M_0	1.96	24.36^{abcd}	16.33	92.36
N_3M_1	2.88	26.51^{a}	17.79	144.67
N_3M_2	2.56	25.59^{ab}	17.25	132.78
N_3M_3	2.31	24.25^{abcde}	16.86	110.44
LSD (0.05)	-	2.467	-	-
Level of significance	NS	0.01	NS	NS
CV (%)	8.82	6.49	7.88	6.32

Significant difference was recorded in diameter of head of Chinese cabbage with different doses of nitrogen fertilizer applied in the present experiment. The highest diameter head (17.06cm) was recorded in N_3 which was statistically similar with N_2 and N_1 (16.55cm and 16.08cm, respectively). The lowest diameter of head (14.21 cm) was recorded in N_0 (Table 1). Diameter of head at different mulches which was used in the present experiment showed significant variation. The highest diameter of head (16.86 cm) was recorded in M_1 which was statistically identical with N_2 (16.40cm) and the lowest diameter (15.10cm) was recorded in M_0. Diameter of head in Chinese cabbage showed no statistically difference in relation with interaction effect between nitrogen fertilizer and mulches. The highest diameter of head (17.79cm) was recorded in N_3M_1 and the lowest diameter of head (12.55cm) was recorded in N_0M_0 (Table 2).

Marketable yield per hectare showed statistically significant differences with different doses of nitrogen fertilizer applied in the present experiment. Nitrogen fertilizer showed a gradual increasing tendency to marketable yield per hectare. The highest marketable

yield per hectare (120.06 ton) was recorded in N_3 which was closely followed with N_2 and N_1 (110.65 and 107.09 ton). On another way the lowest marketable yield per hectare of Chinese cabbage (67.90 ton) was recorded in N_0. Marketable yield per hectare at different mulches showed significant difference. The highest marketable yield per hectare (123.27 ton) was recorded in M_1 which was closely followed by M_2 (111.01 ton) and the lowest marketable yield (76.51 ton) was recorded in M_0 which was closely followed by M_3 (94.91 ton). Marketable yield per hectare showed no statistically significant variation in relation with interaction effect between nitrogen fertilizer and mulches. The maximum marketable yield per hectare (144.67 ton) was recorded in N_3M_1 and the minimum (45.60 ton) was recorded in N_0M_0.

Table 3. Cost and return of Chinese cabbage cultivation as influenced by nitrogen fertilizer and mulching

Treatment combination	Cost of production (Tk./ha)	Yield of Chinese cabbage	Gross return (Tk./ha)	Net return (Tk./ha)	Benefit cost ratio
N_0M_0	187596	45.60	228000	40404	1.22
N_0M_1	200112	81.21	406050	205938	2.03
N_0M_2	198427	76.23	381150	182723	1.92
N_0M_3	194215	68.56	342800	148585	1.77
N_1M_0	190147	81.62	408100	217953	2.15
N_1M_1	202663	131.80	659000	456337	3.25
N_1M_2	200978	116.11	580550	379572	2.89
N_1M_3	196766	98.83	494150	297384	2.51
N_2M_0	190484	86.47	432350	241866	2.27
N_2M_1	203000	135.41	677050	474050	3.34
N_2M_2	201315	118.90	594500	393185	2.95
N_2M_3	197103	101.82	509100	311997	2.58
N_3M_0	190905	92.36	461800	270895	2.42
N_3M_1	203421	144.67	723350	519929	3.56
N_3M_2	201736	132.78	663900	462164	3.29
N_3M_3	197524	110.44	552200	354676	2.80

In the combination of different doses of nitrogen fertilizer and different mulches highest gross return (Tk. 723,350) was obtained from the treatment combination of N_3M_1 and the second highest gross return (Tk. 677,050) was obtained in N_2M_2. The lowest gross return (Tk. 228,000) was obtained in N_0M_0. In case of net return different treatment combination showed different types of net return. In the combination of different doses of nitrogen fertilizer and different mulches highest net return (Tk. 519,929) was obtained from the treatment combination N_3M_1 and the second highest net return (Tk. 474,050) was obtained in N_2M_1. The lowest net return (Tk. 40,404) was obtained in N_0M_0. In the combination of different doses of nitrogen fertilizer and different mulches highest benefit

cost ratio (3.56) was attained from the treatment combination of N_3M_1 and the second highest benefit cost ratio (3.34) was acquired in N_2M_1 and lowest (1.22) was obtained in N_0M_0.

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