Himachal Journal of Agricultural Research 35 (1): 125-128, 2009

Short Note

Influence of topping and nitrogen on tartary buckwheat

S. S. Rana, Pawan K. Pathania, Desh Raj Chaudhary, Kapil Saroch and M. C. Rana
Department of Agronomy, College of Agriculture
CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur 176 062, India.

Abstract

A field experiment was conducted during the summer seasons of 1999 and 2000 at Mountain Agricultural Research and Extension Centre, Sangla to study the response of buckwheat to nitrogen in relation to topping. The treatments were the combinations of topping or no topping (control) and three nitrogen levels *viz.* 20, 40 and 60 kg/ha. Results revealed that topping (the cutting off of the top at knee high stage of the crop) decreased lodging and increased grains/plant, grain yield and net returns. On an average, topping increased grain yield and net returns by 14.83 and 14.66%, respectively over the control treatment. 20 kg N/ha with topping was at par with 40 kg N/ha without topping in influencing yield and returns. It indicated that topping could economize the dose of nitrogen by 50%. However, highest grain yield and net returns were obtained with 60 kg N/ha along with topping. When topping was not done, there was drastic reduction in yield and returns with 60 kg N/ha over 40 kg N/ha. The mean optimum dose of N was 47.42 kg/ha, which gave response of 686.7 kg/ha with respect to grain yield. The response per kg N was 14.48 kg grain. Optimum dose of N due to topping was 2.25 times higher than control. It indicated that with topping buckwheat crop could respond to higher dose of N.

Key words: Tartary buckwheat, topping, nitrogen, lodging.

Tartary buckwheat (*Fagopyrum tataricum* L.) has recently been attracting interest not only in agriculture but in medical sciences as well (Liu and Fu, 1995; Yamazaki *et al*, 1995). Tartary buckwheat is widely cultivated as a traditional crop over a long time (Joshi, 1999) in the Himalayan regions. In higher altitudes this was a main crop whereas in low altitudes and plains it is cultivated for tender leaves. Various dishes are prepared from buckwheat grains and leaves and preferred over cereals like wheat, maize and rice (Sood *et al*, 2003). In order to meet the future demand, focus on suitable management strategies would be necessary. Fertilizers especially nitrogenous are the kingpins for increasing the productivity of the crop (Saini and Negi, 1998). However, higher nitrogen promotes vegetative growth and induces lodging. Lodging is reported to be one of the limiting factors of Tartary buckwheat production (Baniya, 1990). To combat lodging, growers usually practice topping. Topping also known as clipping (the removal of terminal bud) is usually done just before or at the emergence of flowering. But earlier studies showed that topping at knee high stage of the crop was promising in boosting buckwheat productivity (Badiyala and Saroch, 1995). It is therefore, imperative to study the response of nitrogen on Tartary buckwheat in relation to topping.

The experiment was conducted during the summer seasons of 1999 and 2000 at Mountain Agricultural Research and Extension Centre, Sangla (31°25′57′′N, 78°15′4′′E and 2591 m altitude). The soil of the experimental site was sandy loam in texture, neutral in reaction (pH 6.8) with organic carbon content 0.68%, available N 278 kg/ha, available P 18.9 kg/ha and available K 209 kg/ha. The treatments evaluated were the combinations of topping or no topping (control) and three nitrogen levels *viz.* 20, 40 and 60 kg/ha. The treatments were tested in randomized block design with five replications. Topping (the cutting off of the top) was done at knee high stage (55 days after sowing) of the crop. During 1999, topping was done from middle of the plant whereas in 2000, top clipping was done (only the terminal bud was cut off). The crop was sown at 30 cm row spacing after pre-sowing irrigation. Half N and 40 kg P_2O_5/ha and 20 kg K_2O/ha was applied as basal through urea, single super phosphate and muriate of potash, respectively. Remaining N as per the treatment was top-dressed at knee high stage of the crop. For weed control, pre-emergence application of alachlor at 1.00 kg/ha was made next day of sowing. The rest of the management practices were in accordance with the recommended package of practices.

Growth and yield attributes were recorded at harvest. Lodging (LD) in the scale of 1 to 5 on the basis of the angle between the ground and the top of the main stem was defined as: the score is 1 for angle 90-73°, 2 for 72-55°, 3 for 54-37°, 4 for

36-19° and 5 for 18-0° (Hagiwara *et al.* 1999). Grain and straw yields were harvested from net plot. Economics of the treatments was computed based upon the prevalent market prices (Indian Rupee).

Effect of topping

The data presented in table 1 revealed that removal of terminal bud due to topping resulted in significant reduction in plant height and number of primary branches/plant during both the years. Lodging as expressed in terms of lodging degree tended to be reduced owing to reduced plant height, in topping over the control treatment.

The less lodging and lateral expansion in growth as evidenced by an increase in the length of primary branches seem to have contributed towards significant increase in fertilized ovules (ripened grain) per plant in topping over the control treatment (Table 2). Plant population was not affected significantly due to topping; however, it tended to be higher during 2000 as compared to 1999. Owing to reduced lodging and increase in grains/plant, grain yield tended to be significantly higher following the practice of topping. An increase in mean grain yield to the tune of 14.83% was recorded due to topping over the control treatment. Crop production in dry temperate region is limited to summer only as the fields remain snow covered during winter. Crop refuse in the form of straw is therefore, vital as the fodder/dry hay is always scarce. In 1999, clipping was done from middle of the plant and straw yield reduced significantly over control. But in 2000 when only the terminal bud was cut off, straw yield was not affected significantly. Buckwheat mean straw yields due to topping were also statistically similar as control.

Table 1. Effect of clipping and nitrogen on growth and yield contributing traits of tartary buckwheat

Treatments	Plant height (cm)		Plants/m²		Branches/plant		Branch length (cm)		Lodging degree	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Clipping methods										
No clipping	121.7	137.0	114.8	158.1	8.76	6.23	40.2	38.8	3.71	2.49
Clipping	112.2	115.1	114.8	156.1	7.33	5.41	57.7	58.3	1.93	1.29
LSD (P=0.05)	2.7	3.0	NS	NS	0.41	0.40	5.6	4.9	1.08	0.72
Nitrogen levels (kg/ha)										
20	113.2	118.1	113.2	156.4	7.33	5.22	35.9	40.2	2.58	1.54
40	117.3	126.9	118.1	154.1	8.17	6.07	50.5	49.4	2.55	1.54
60	120.3	133.3	112.9	161.0	8.63	6.18	57.4	56.1	3.32	2.60
LSD (P=0.05)	3.0	5.8	NS	NS	0.50	0.49	6.9	6.0	NS	NS

Table 2. Effect of topping and nitrogen on yield contributing traits, yield and economics of Tartary buckwheat

Treatments	Grains/plant		Grain yield (kg/ha)		Straw yield (kg/ha)		Net returns (Rs/ha)	B:C ratio
	1999	2000	1999	2000	1999	2000		
Clipping methods								
No clipping	362.4	202.4	1764	2351	3610	2853	23148	3.65
Clipping	390.4	255.2	1945	2731	3380	2976	26541	3.71
LSD (P=0.05)	17.6	15.8	39	59	167	NS	813	NS
Nitrogen levels (kg/ha)								
20	350.0	199.0	1742	2375	3390	2636	22980	3.49
40	389.2	238.3	1929	2622	3670	3050	26018	3.87
60	390.2	249.0	1892	2626	3420	3059	25536	3.69
LSD (P=0.05)	21.6	19.3	47	72	205	83	997	0.12

Effect of nitrogen

Plant height, number of branches/plant, length of branch and grains per plant tended to be increased with increasing nitrogen dose. However, branches/plant and grains/plant were not increased significantly due to 60 kg N/ha over 40 kg N/ha. In the present investigation no significant relation between lodging and N was observed, as differences in lodging degree due to N were not significant, however, lodging tended to be higher using the higher dose *i.e.* 60 kg N/ha.

Nitrogen at 40 kg/ha resulted in significantly higher grain and straw yields over 20 kg/ha. The increase in yield was owed to increase in growth and yield attributes. Grain and straw yields decreased significantly with 60 kg N/ha over 40 kg N/ha. Buckwheat was regarded as a crop of poor soils (Anonymous, 1958), and the recent developments that the buckwheat plant has its own potential for fixing atmospheric nitrogen (Lakhova, 1998; Alekseyeva, 2002) suggested that higher nitrogen is not at all required for its sustainable productivity.

Interaction

Interaction between topping and nitrogen was significant for grain and straw yields during both the years. At each N level, topping has increased the mean grain yield significantly over the control treatment (No topping). When topping was not done, response to N in increasing grain and straw yields was up to 40 kg/ha, whereas, it was up to the highest level tried i.e. 60 kg/ha it was done. It clearly depicts that topping could help responding Tartary buckwheat to higher dose of N. Decrease in yield due to 60 kg/ha over 40 kg/ha in the control treatment (no topping) was mainly ascribed to early lodging. Baniya (1990) has also reported that lodging is one of the major limited factors in yield reduction in Tartary buckwheat. Increased lodging and decreased yields due to higher N rates have been documented (Trusova, 1976). It is pertinent to highlight that grain yield following 40 kg N/ha without topping was statistically at par with grain yield following 20 kg N/ha with topping. It indicated that topping could economize the dose of N by 50%.

The relationship of grain yield and applied N was studied with the help of regression equations as given in table 3. The optimum dose of N was worked out to be 47.42 kg/ha (equation 1), which gave response of 686.7 kg of grains/ha. The response per kg N was 14.42 kg grain. Interestingly, optimum dose of N due to toping (equation 3) was 2.25 times higher than no topping. It further indicated that topping could withstand higher dose of N for maximum productivity. However, response of N in increasing grain yield at optimum dose due to topping (634.4 kg/ha) was low as compared to no topping treatment (923.5 kg/ha).

Owing to higher yield, net returns tended to be increased using topping over the control treatment irrespective of the N level tried. On an average net returns due to topping increased by 14.66% over no topping. While topping was not done, net returns and B: C ratio decreased following 60 kg N/ha over 40 kg N/ha. However, when topping was done net return and B:C ratio were increased with increasing dose of N. 60 kg N/ha along with topping resulted in maximum net returns of Rs 28587/ha followed by 40 kg N/ha with toping. However, 40 kg N without topping was statistically at par with 60 kg N/ha with topping in influencing B: C ratio.

Table 3. Response equations

Response equation	Maximum dose (MD)	Optimum dose (OD)	Yield at MD	Yield at OD
1. $Y=1610+28.26N-0.291\ N^2$	48.56	47.42	2297.1	2296.7
2. $Y=1274+43.67N-0.516N^2$	42.32	41.67	2197.7	2197.5
3. $Y=1946+12.85N-0.065N^2$	98.85	93.74	2581.1	2579.4

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