Effects of Different Levels of Boron on Cauliflower (*Brassica oleracea* var. botrytis) Curd Production on Acid Soil of Malepatan, Pokhara

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ABSTRACT

Experiments were conducted in two consecutive years (2000 and 2001) at Agricultural Research Station, Malepatan to evaluate the effects of boron levels on cauliflower curd production. A randomized complete block design with three replications was employed. Six levels of boron (0 kg, 5 kg, 10 kg, 15 kg, 20 kg and 25 kg borax ha^{-1}) were tested. Fertilizers and manures were applied at the rate of 120:60:40 kg $N:P_2O_5:K_2O$ and 10 tons of compost per hectare in all the plots. The variety used in the experiment was Kibogiant. The growth (plant height, leaf numbers, leaf length and fresh biomass production) was affected by the boron levels. The maximum plant height (42.05 cm) was observed when the crop was supplied with 25 kg borax ha^{-1} which was almost 13.95 percent higher than that of non-treated control crop. Maximum leaf numbers (12.73 $plant^{-1}$) and leaf length (38.91 cm) were observed when the crop was fertilized with 10 kg borax ha^{-1}. The maximum biomass production (1.06 kg $plant^{-1}$) was obtained with the crop treated with 25 kg borax ha^{-1}. The curd size (diameter) was increased with increasing levels of borax upto 15 kg ha^{-1}. The maximum curd diameter (10.28 cm) was produced when the crop was treated with 25 kg borax ha^{-1}. Highly significant effect of boron levels were observed on the curd production. The two years mean showed an increasing curd production trend with increasing levels of borax application. The maximum curd weight (10.9 t ha^{-1}) was observed when the crop was supplied with 25 kg borax ha^{-1}. However, nonsignificant differences on curd production were observed between 15 kg, 20 kg and 25 kg borax application per hectare.

Key words: Boron, *Brassica oleracea* var. botrytis, curd production

INTRODUCTION

Cauliflower (*Brassica oleracea* var. botrytis) can be grown in all types of soil with good soil fertility and good water regime. Because of over mining of the plant food elements by the crops, most of the micronutrients become in short-supply to the crops and some disorders appear resulting in low yields (Joshi 1997). Some of the micronutrients required by cauliflower crop become unavailable if the soil condition is acidic, such as molybdenum. In cauliflower (*Brassica oleracea* var. botrytis) boron deficiency has been reported very frequently (Som and Maity 1986). At the time, external symptoms of boron deficiency is not apparent. The first sign is the appearance of small water soaked areas in the center of the curd. In later stages and in seriously affected plants, the stem becomes hollow with water socked tissue surrounding the walls of the cavity. In more advanced stages, pinkish or rusty brown area develop on the surface of the curd which is known as Red rot and cause low curd yield. This may be controlled by applying borax or sodium borate at the rate of 20 kg ha^{-1} (Chatterjee 1986). He further reported that boron and molybdenum increased the curd size and weight. Ghimire (1991) reported that the highest yield (15.45 t ha^{-1}) was obtained when the crop was supplied with 22.5 kg borax ha^{-1}. In another experiment conducted at Agriculture Research Station, Malepatan, Pokhara, maximum curd yield (15.23 ton^{-1}) was produced by snowball-16 cauliflower when the crop was supplied with 15 kg of borax ha^{-1} (ARS 1992). Similar study was conducted at Agricultural Research Station, Malepatan and highest curd yield (12.95 t ha^{-1}) was obtained in the variety Kibogiant when the crop was fertilized with 25 kg of borax ha^{-1} (ARS 2002). A normal crop usually contains only a

fraction of a pound of boron per hectare. The symptoms show mostly on young leaves because boron is relatively non-mobile in plants (Thompson and Troeh 1957). The requirement of boron quantity by the crops depends upon the variety and soil fertility status of the area. Therefore, it has been necessary to determine the rate of boron application to the cauliflower. So this experiment was conducted with an objective of evaluating the application of different levels of boron on the production of the cauliflower curds.

MATERIALS AND METHODS

For evaluating the effects of different boron levels on the cauliflower curd production field experiments were conducted for two consecutive years (2001 and 2002) at Agriculture Research Station Malepatan, Pokhara in acid soil (pH 4.6) at an altitude of 848 masl. A randomized complete block design with three replications was employed. Six levels of boron (0 kg borax ha^{-1}, 5 kg, 10 kg, 15 kg, 20 kg and 25 borax ha^{-1}) were taken for the study. The plot size was 3.6- × 3-m, a total of 10.8 m^2 and the crop was transplanted in November at a spacing of 60- × 60-cm. Ten tons of compost plus 100:60:40 kg ha^{-1} of $N:P_2O_5:K_2O$ was applied in all the plots. Half Nitrogen was applied as basal application and the other half as top dressing after 45 days. The crop was harvested in February. Ten plants per plot excluding boarder rows, were taken into the study. Plant growth and yield characters were recorded and analysed statistically by least significant differennce test (Gomez and Gomez 1984). The curd production per plot was converted to t ha^{-1} by simple arithmatic calculation.

RESULTS AND DISCUSSION

Two years mean plant growth results (Table 1) revealed that minimum plant hight (36.18 cm) was observed with non- treated control plot whereas the maximum plant hight (42.05 cm) was obtaind by the crop supplied with 25 kg borax ha^{-1} which was 13.95% higher than that of control. Plant height was increased approximately by 10 % when the crop was supplied with 5 kg or 10 kg of borax ha^{-1}. Plant height was observed increasing with increasing levels of borax application. Maximum plant height (42.05 cm) was observed when the crop was supplied with 25 kg of borax ha^{-1} which was almost 13.9% higher than those with non-treated control crop (36.18 cm). In another study conducted at ARS, Malepatan, maximum plant height was recorded with the application of 22.5 kg of borax ha^{-1} which justify and support the result of this investigation (ARS 1992). Leaf numbers (12.73) were increased to maximum when the crop was fertilized with 10 kg^{-1} of borax. Lowest leaf numbers (11.4) were produced by non-treated crop whereas maximum numbers (12.73 leaves) were produced by the crop treated with 10 kg borax ha^{-1} which was higher by 10.13% as compared to those produced by the crop at zero level of borax application. The leaf numbers were observed to be decreased with increased level of borax application beyond 10 kg borax ha^{-1} (Table 1). Similar results were also observed in the increase of leaf length. Highest leaf length (38.91 cm) was observed when the crop was supplied with 10 kg ha^{-1} of borax which was 11.48% higher than those produced by non-treated crop (34.44 cm). Borax applied at 15 or 20 kg ha^{-1} did not produce increased leaf length (36.43 cm and 37.63 cm, respectively), however, 25 kg of borax application increased the leaf length (38.43 cm) by 10.38% as compared to those produced at zero level of boron application (Table 1). The maximum biomass (1175.2 g $plant^{-1}$) was observed in the first year when the crop was fertilized with 25 kg borax ha^{-1}, whereas it was maximum (1037.5 g $plant^{-1}$) in the second year when it was supplied with 20 kg of borax ha^{-1} (Table 2). The highest mean biomass production (1061.4 g) was obtained when the crop was supplied with 25 kg borax ha^{-1}.

Significant efffect of boron levels on the production of curd hight was observed in the first year (2001) whereas it was observed non-significant in the second year (2002) (Table 2), which is probably due to the residual effect of boron applied in the first year. The curd hight was observed increasing with increasing levels of boron in the first year (2001) but in the second

year (2002) it was only incresing up to 10 kg borax ha^{-1} (7.58 cm). The curd hight was observed decreasing after 15 kg of borax applied to cauliflower plants with increasing levels of boron (15 kg, 20 kg and 25 kg ha^{-1}). However, the two years mean indicated that maximum curd height (7.89 cm) was observed when 25 kg borax ha^{-1} was applied (Table 2). The curd size (diameter) was also influnced by the boron levels. The increasing levels of boron increased curd size (diameter) in the first year (2001) whereas it was increasing only upto 10 kg of borax in the second year (2002) and was non-significant. The mean results on curds size reveled that maximum curd size (diameter) was obtained (10.28 cm) when the crop was supplied with 10 kg of borax ha^{-1}.

The persual data from Table 3 showed that maximum curd yield (12.95 t ha^{-1}) was observed in the first year when the crop was supplied with 25 kg borax ha^{-1} which was higher than the control plot (3.21 t ha^{-1}). Non-significant difference were observed among 5 kg, 10 kg and 15 kg borax ha^{-1}. Similarly, non-significant difference between 20 kg and 25 kg borax was observed in the first year. Significant response of boron levels over control plot was observed in the second year. The curd weight was increasing upto 20 kg of borax application, however non-significant differences among the levels of borax were observed in the second year. The two years mean yield result (Table 3) showed a sharp response of increasing levels of boron on curd production. A minimum of 2.7 t ha^{-1} curds were produced by non-treated crop whereas the maximum curd yield (10.9 t ha^{-1}) was obtained when the crop was supplied with 25 kg ha^{-1} of borax which was 403.7% higher than that of the control plot (Table 3). A minimum of 297.7% yield increment (8.04 t ha^{-1}) over control plot was observed when the crop was supplied with 5 kg borax ha^{-1}. However non-significant differences were observed among 15 kg, 20 kg and 25 kg ha^{-1} of borax application.

Plant growth (plant height, leaf number, leaf length and biomass production) were observed to be affected by the different boron levels applied to the cauliflower plants. Maximum biomass (1061.4 g $plant^{-1}$) was produced when the crop was fertilized with 25 kg borax ha^{-1}. 10.9 t ha^{-1} of curds could be produced when the crop was supplied with 25 kg of borax ha^{-1} which is 403.7% higher than the control plot (2.7 t ha^{-1}). Non-significant difference in curd production were observed among 15 kg, 20 kg and 25 kg borax ha^{-1} application. However it seems that application of 25 kg borax ha^{-1} could be economical in acid soil condition.

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