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# Effect of boron and molybdenum on incidence of disorders and seed yield of cauliflower (*Brassica oleracea* var. *botrytis)*

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## Abstract

**Studies were conducted at ten locations in the farmer's field of Kandaghat block of Solan in Himachal Pradesh. Two treatments viz. $T_1$ (Soil application of borax @ 25 Kg/ha. + ammonium molybdate @ 1.5 kg/ha before sowing) and $T_2$ ($T_1$ + foliar spray of boric acid @ 0.1% + ammonium molybdate @ 0.05 % at the time of curd initiation and bolting) were compared with each other as well as with farmer's practice (No application of boron and molybdenum). It was observed that during both the years, seed yield, seed germination, net profit and B: C ratios were higher in $T_2$ followed by $T_1$ and farmer's practice, respectively. Incidence of whiptail and browning disorders were also minimum in $T_2$ followed by $T_1$ and farmer's practice.**

## Introduction

Cauliflower *(Brassica oleracea* var. *botrytis)* is one of the most important vegetable crops of India. Kandaghat is one of the selected belts of Solan district, famous for the production of quality seed of late cauliflowers. Among the varieties grown for Seed production, Pusa Snowball K-1, (a late variety) is popular among farmers of this area since it fetches good premium, both as curd as well as seed crop. The seed of late cauliflower can only be raised under sub-temperate conditions as it require low temperature during curd development followed by mild temperature during reproductive stage (Gill and Singh, 1977). Cauliflower is a biennial crop for seed purpose and requires large quantities of inorganic and organic fertilizers. Till date, majority of the cauliflower growers of Solan district, apply only nitrogen as inorganic fertilizer, irrespective of the requirements of soil or the crop. In a survey, it has been reported that the farmers are using only nitrogen as fertilizer for the last 20 years in the form of urea or CAN and none is applying P, K or other micro nutrients (Anonymous, 1999). This excessive and indiscriminate use of nitrogenous fertilizers, not only promote vegetative growth, invite diseases and pests but also make the soil deficient of P, K and other micronutrients. Besides, the deficiency of boron and molybdenum is responsible for the development of some disorders like browning and whiptail. Though, information is available on the effect of N and P on quality seed production, there is no report available on the use of micro nutrients from the state of Himachal Pradesh (Sharma, 2002). The soils of Solan district have been reported to be deficient in boron (Bhandari and Thakur, 1985). Keeping in view the farmer's unawareness regarding the application of micronutrients the present investigation was planned to study the effect of boron and molybdenum on seed yield and incidence of disorders in cauliflower.

## Material and Methods

The experiment was conducted in the farmer's field in Kandaghat block of Solan district (HP) during 1998-99 and 1999-2000 under the project "Technology Assessment and Refinement". The treatments consisted of $T_1$ (Soil application of borax @ 25 kg/ha + ammonium molybdate @ 1.5 kg/ha before sowing), $T_2$ ($T_1$ + Foliar spray of boric acid @ 0.1 per cent + ammonium molybdate @ 0.05 per cent at the time of curd initiation and bolting) and Farmer's Practice (No application of boron and molybdenum). The experiment was laid out in a Randomized Block Design with 10 replications. Thirty days old seedlings

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of cauliflower cv. Pusa Snow Ball K-1 were transplanted in the first week of October during 1998-1999 and 99-00.The plot size was 2 x 2 $m^2$ and the plants were spaced at a spacing of 60 x 45 cm. All the recommended cultural practices like hoeing, weeding, irrigation, and application of fertilizers and pesticides were followed from time to time to ensure a healthy crop stand (Anonymous 2005). The seed crop was harvested at 75 per cent pod maturity and curing was done for 7 to 10 days. The data were recorded on the incidence of browning and whiptail (%), seed yield (kg) and seed germination (%) and analyzed following the methods suggested by Gomez and Gomez (1984).

## Results and Discussion

It is evident from the data (Table-1) that during both the years of experimentation, significant increase in seed yield was recorded over control with the application of borax, boric acid and ammonium molybdate both as soil application as well as foliar spray. Yield increase of 27.87 and 34.11 per cent were recorded during both the years of experimentation when borax and ammonium molybdate were mixed in the soil as pre sowing soil application ($T_1$). Proportionate increase of 35.39 and 45.09 per cent in seed yield was recorded with the application of boron and molybdenum, both as soil application and as foliar spray i.e. in $T_2$. Among the two treatments ($T_1$ and $T_2$) of micro nutrients, the latter showed significant yield increase over the former. The probable reason for enhanced seed yield of better quality might be due its role in enhancing the translocation of carbohydrates from the site of its synthesis to the storage organs. Thakur *et al.* (1991) as well as Malewar and Indulkar (1993) have also reported the promotive effect of boron application on cauliflower curd production. On the other hand, the probable reason for enhanced seed yield of better quality by molybdenum application might be due to its effect on vegetative growth, which ultimately has led to more photosynthetic activities. Sharma *et al.* (1988) and Sharma (2002) have also reported increased curd yield due to molybdenum application. With the soil and foliar application of boron, the incidence of browning disorder got reduced to 73.91 and 74.09 per cent, respectively during the two years of experimentation, respectively. Similarly, the same treatment decreased the incidence of whiptail by 73.29 and 84.94 per cent during the two years of experimentation, respectively. Although, the application of these two micro nutrients as soil application ($T_1$) reduced the incidence of two disorders i.e. browning and whiptail ranging between 61.44 to 66.30 and 64.20 to 74.73 per cent, respectively over the control. The reduction in the incidence of these disorders due to the application of boron and molybdenum (both soil application and foliar spray) might be attributed to the fact that these two elements are responsible for providing defense mechanism to the plant against the disorders. Highest seed germination of 65 per cent was recorded in the seeds harvested from the fields with $T_2$ treatment followed by $T_1$ and control, the variation remained statistically non significant during both the years of experimentation. Whereas, net profit earned by the farmers with the application of these two nutrients ranged between 27.87 to 34.11 and 35.39 to 45.09 per cent, respectively, the profit per cent was more in $T_2$ as compared to $T_1$. From the foregoing discussions, it can be concluded that boron and molybdnum both as soil application and foliar sprays were effective in reducing the incidence of browning and whiptail disorders, thereby enhanced the net profit of the growers significantly.

**Table 1.Effect of boron and molybdenum on incidence of disorders and seed yield of cauliflower**

| Year | Treat-ments | Seed Yield (q/ha) | Increase in yield over control (%) | % Incidence of | | % Reduction in incidence of | | Seed Germi-nation (%) | Total income (Rs.) | Increase in income over FP | | B:C ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Brow-ning | Whip-tail | Brow-ning | Whip-tail | | | Rs. | % | |
| 1998-99 | FP | 4.52 | - | >16.6 | >18.6 | - | - | 60 | 2,26,000 | - | - | - |
| | T1 | 5.78 | 27.87 | <6.4 | <4.7 | 61.44 | 74.73 | 62 | 2,89,000 | 63,000 | 27.87 | 2.78:1 |
| | T2 | 6.12 | 35.39 | <4.3 | <2.8 | 74.09 | 84.94 | 65 | 3,06,000 | 80,000 | 35.39 | 3.53:1 |
| 1999-00 | FP | 4.28 | - | >18.4 | >17.6 | - | - | 60 | 2,56,800 | - | - | - |
| | T1 | 5.74 | 34.11 | <6.2 | <6.3 | 66.30 | 64.20 | 63 | 3,44,400 | 87,600 | 34.11 | 3.41:1 |
| | T2 | 6.21 | 45.09 | <4.8 | <4.7 | 73.91 | 73.29 | 65 | 3,72,600 | 1,15,800 | 45.09 | 4.50:1 |
| CD (P=0.05) | - | 0.38 | - | - | - | - | - | NS | - | - | - | - |

Sale Rate: 1998-99: Rs 500/kg 1999-00: Rs 600/kg

FP: Farmer's Practice (No application of boron and molybdenum)

$T_1$: Soil application of borax @ 25 Kg/ha. + ammonium molybdate @ 1.5 kg/ha before sowing.

$T_2$: $T_1$ + Foliar spray of boric acid @ 0.1% + ammonium molybdate @ 0.05 % at the time of curd initiation and bolting.

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