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# Effect of method of fertilizer application and weed control on nutrient uptake by mustard (*Brassica juncea*) and associated weeds

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## ABSTRACT

A field experiment conducted during the winter seasons of 1985–86 and 1986–87 with 'Kranti' mustard [*Brassica juncea* (L.) Czernj. & Cosson] showed that side placement of NPK fertilizers near the crop rows at sowing and side-dressing of urea in the standing crop significantly reduced the dry-matter production and NPK removal by weeds compared with broadcast application of fertilizers at both the stages. One hand-weeding with or without hoeing and pre-emergence application of isoproturon @ 0.75 kg/ha and thiobencarb @ 1.0 kg/ha also caused considerable reduction in the dry weight of weeds and NPK removal by them compared with the unweeded check. The reverse was true for mustard crop as regards dry-matter production and NPK uptake.

Uncontrolled weed growth in mustard [*Brassica juncea* (L.) Czernj. & Cosson] throughout the crop season causes loss of 14.6 kg N/ha (Dashora *et al.*, 1990).

Besides chemical and mechanical weedings, other agronomic practices may also play a vital role in weed management. Weeds growing more than 20 cm away from the zone of nitrogen application failed to make use of added nutrients and remain stunted. In situation where weed growth is profuse, fertilizer may be drilled or placed along or adjacent to the crop row and applied in split doses to avoid the nutrient removal by weeds in large amounts. The present investigation was, therefore, undertaken to study the extent of nutrient removal by mustard crop and associated weeds under different methods of fertilizer application and weed control.

## MATERIALS AND METHODS

The experiment was laid out at Faizabad during the winter seasons of 1985–86 and 1986–87. The soil of the experimental field was sandy or silty loam having medium level of fertility. Four methods of fertilizer application, viz. broadcast basal application [broadcasting in standing crop (BB)], broadcast basal application [side-dressing in standing crop (BS)], side placement at sowing [broadcasting in standing crop (PB)] and side placement at sowing + side-dressing in standing crop (PS), were tested in combination with 5 weed-control treatments, viz. weedy check ($W_0$), 1 hand-weeding at

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25 days after sowing ($W_1$), hoeing at 25 days after sowing + hand-weeding at 35 days after sowing ($W_2$), isoproturon @ 0.75 kg/ha pre-emergence ($W_3$) and thiobencarb @ 1.0 kg/ha pre-emergence ($W_4$). Twenty treatments were replicated 4 times in randomized block design.

'Kranti' mustard was sown @ 6 kg/ha in rows spaced 45 cm apart. Seeding was done on 29 October 1985 and on 25 October 1986. Thinning was done at 15 and 25 days after sowing to maintain plant-to-plant distance of 15 cm. At the time of sowing, 60 kg N, 40 kg $P_2O_5$ and 40 kg $K_2O$/ha were applied by side placement or broadcasting and at pre-flowering stage 60 kg N/ha through urea was applied by broadcasting or putting it on 1 side of crop rows (side-dressing) as per treatment. This crop received 3 irrigations in addition to 1 as pre-sowing irrigation. Other cultural practices and plant-protection measures except weed control, were followed as per recommendations.

Estimation of N, P and K contents in weeds and mustard plant was done at harvest. Nitrogen was analysed by Kjeldahl's method (Jackson, 1963) and phosphorus and potasium as per the method given by Jackson (1963).

## RESULTS AND DISCUSSION

Different treatments significantly affected the dry-matter accumulation and depletion of N, P and K by weeds (Table 1). Increase in the dry matter of weeds under broadcasting method of fertilizer application in comparison to side placement and side-dressing might be due to the fact that weeds availed of greater quantities of applied nutrients spread evenly in the soil in the broadcast method. This resulted in better growth and higher dry-matter production, which ultimately increased the loss of nutrients by weeds. The results clearly indicate that application of fertilizers near the crop rows in mustard which is widely spaced can serve as an useful tool in weed management by favouring the crop growth and discouraging the weeds.

All mechanical and chemical weed-control treatments significantly reduced the dry matter compared with the unweeded control. The dry matter of weeds was directly related to removal of nutrients by them.

In the unweeded plots, highest dry matter of weeds was produced because of their higher population and unchecked growth. The removal of N, P and K by weeds was reduced significantly by various herbicidal and manual weeding treatments and it was minimum under $W_2$ treatment. However, they were at par in respect of NPK uptake/ha by the weeds. These observations are in agreement with those of Thakur (1988) and Dashora *et al.* (1990).

Total biological yield of mustard under various methods of fertilizer application differed significantly (Table 2). Increase in total abiological yield of mustard due to PS, PB and BS treatments over BB treatment was 45.2, 30.8 and 11.5% during 1985–86 and 44.5, 41.2 and 16.1% during 1986–87 respectively. The results indicate that placement and side-dressing of fertilizer increases the nutrient availability to crop plants and reduces competition from weeds, which ultimately improves the growth and yield of crop.

The total biological yield of crop was significantly higher in chemical and hand-weeding treatments compared with weedy check. The performance of thiobencarb, isoproturon and 1 hard-weeding + hoeing was almost similar to each other but was significantly better than 1 hand-weeding

**Table 1.** Effect of methods of fertilizer application and weed control on dry-matter production and nutrient removal by weed in mustard at harvest

| Treatment | Weed-dry matter (q/ha) | | Nutrient removal (kg/ha) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | N | | P | | K | |
| | 1985–86 | 1986–87 | 1985–86 | 1986–87 | 1985–86 | 1986–87 | 1985–86 | 1986–87 |
| *Fertilizer method* | | | | | | | | |
| BB | 6.55 | 12.63 | 8.42 | 19.70 | 1.72 | 3.23 | 14.59 | 27.12 |
| BS | 4.49 | 10.12 | 6.62 | 14.82 | 1.08 | 2.32 | 9.53 | 20.78 |
| PB | 3.91 | 8.10 | 5.41 | 11.16 | 0.78 | 1.49 | 6.63 | 12.37 |
| PS | 2.91 | 6.23 | 3.71 | 7.39 | 0.49 | 1.00 | 4.38 | 8.14 |
| CD (P = 0.05) | 1.06 | 10.73 | 2.35 | 3.50 | 0.77 | 0.87 | 3.61 | 5.51 |
| *Weed control* | | | | | | | | |
| $W_0$ | 7.40 | 15.22 | 11.26 | 23.24 | 1.78 | 3.52 | 15.49 | 30.80 |
| $W_1$ | 4.55 | 9.15 | 6.56 | 13.01 | 1.03 | 1.96 | 8.41 | 16.53 |
| $W_2$ | 3.43 | 6.77 | 4.78 | 9.27 | 0.76 | 1.44 | 6.10 | 12.35 |
| $W_3$ | 3.47 | 7.23 | 4.83 | 9.99 | 0.76 | 1.40 | 6.62 | 11.40 |
| $W_4$ | 3.58 | 7.97 | 5.14 | 10.83 | 0.79 | 1.64 | 6.78 | 14.43 |
| CD (P = 0.05) | 1.18 | 1.93 | 2.63 | 3.91 | NS | 0.97 | 4.03 | 6.16 |

Details of treatments are given under Materials and Methods

**Table 2.** Effect of methods of fertilizer application and weed control on biological yield and uptake of N, P and K by mustard

| Treatment | Weed-dry matter (q/ha) | | Nutrient uptake (kg/ha) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | N | | P | | K | |
| | 1985–86 | 1986–87 | 1985–86 | 1986–87 | 1985–86 | 1986–87 | 1985–86 | 1986–87 |
| *Fertilizer method* | | | | | | | | |
| BP | 59.48 | 50.60 | 71.1 | 58.3 | 6.7 | 5.6 | 93.6 | 78.1 |
| BS | 66.23 | 58.74 | 80.0 | 70.1 | 7.9 | 6.9 | 113.0 | 98.1 |
| PB | 77.81 | 71.46 | 95.4 | 80.1 | 9.9 | 9.1 | 140.1 | 125.8 |
| PS | 86.37 | 73.21 | 107.6 | 87.5 | 12.0 | 10.2 | 169.3 | 141.5 |
| CD (P = 0.05) | 4.93 | 4.02 | 8.72 | 6.95 | 1.86 | 1.69 | 13.76 | 15.98 |
| *Weed control* | | | | | | | | |
| $W_0$ | 52.28 | 43.73 | 61.1 | 49.5 | 6.1 | 5.1 | 89.3 | 72.2 |
| $W_1$ | 72.45 | 62.27 | 89.0 | 73.4 | 9.1 | 7.8 | 127.6 | 106.8 |
| $W_2$ | 80.25 | 71.28 | 99.4 | 81.4 | 10.2 | 9.0 | 145.7 | 128.9 |
| $W_3$ | 77.55 | 68.30 | 94.5 | 81.6 | 9.1 | 8.8 | 142.7 | 123.1 |
| $W_4$ | 79.73 | 71.63 | 97.7 | 84.2 | 10.3 | 9.0 | 139.8 | 123.3 |
| CD (P = 0.05) | 5.51 | 4.49 | 9.75 | 7.77 | 2.08 | 1.89 | 15.38 | 17.87 |

Details of treatments are given under Materials and Methods

during the second year. However, in the first year only thiobencarb and 1 hand-weeding + hoeing treatments gave significantly higher total biological yield over 1 hand-weeding alone. It was mainly attributed to better control of weeds and thereby more availability of soil moisture, light space and nutrients to the crop plants.

The total uptake of 3 major nutrients by mustard crop was mainly influenced by dry-matter production and it was also observed that wherever the removal of nutrients was more through weeds the corresponding uptake by mustard plant was less and vice-versa. Rao *et al.* (1983) also reported that for efficient utilization of applied nutrients, the weeds should be kept under control. Nutrient uptake by mustard increased significantly and consistently by placement and side-dressing methods compared with broadcast basal application and top-dressing of fertilizers.

The maximum NPK removal by crop was noted under placement at sowing in combination with side-dressing (PS), followed by PB, BS and BB methods of fertilizer application. This was mainly due to the fact that better nutrient utilization by crop through placement or side-dressing produced more healthy and vigorous plants and resulted in more dry-matter accumulation, which ultimately increased the total uptake of N, P and K/ha by the mustard crop.

The uptake of N, P and K by mustard crop was significantly higher in hand-weeded and herbicide-treated plots than that in unweeded plots. Obviously, this was due to lesser competition from weeds and ultimately better growth of crop.

Thakur (1988) also reported that weed-free mustard crop removed more amount of N, P and K than the weed-infested crop.

The correlation between total dry matter of weeds at harvest and the dry-matter yield of mustard was found to be negative and significant. A significant negative correlation was noticed between the 3 major nutrients loss through weeds and NPK uptake through crop at harvest.

It was concluded that placement of NPK near the crop rows at sowing followed by side-dressing of urea in standing crop (PS) may serve as an useful tool in weed management in mustard by increasing the crop yield and decreasing the dry-matter production of weed and loss of soil nutrients by weeds.

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