*Indian J. Agron.* **40** (3) : 444–449 (September 1995)

# Integrated weed management and nitrogen in Indian mustard (*Brassica juncea*) and their residual effect on succeeding greengram (*Phaseolus radiatus*)

B. B. KANERIA AND Z. G. PATEL

*Department of Agronomy, N. M. College of Agriculture, Gujarat Agricultural University, Navsari 396 450*

Received: June 1994

ABSTRACT

An experiment was conducted on Vertisol of Navasari during 1989–90 and 1990–91 to study the effect of weed-control practices and nitrogen in Indian mustrard [*Brassica juncea* (L.) Czernj. & Cosson] and their residual effect on succeeding greengram (*Phaseolus radiatus* L.). Ten weed-management treatments were laid out in split-plot design with 3 replications. The greengram crop was superimposed in summer with 2 levels of nitrogen in split-split-plot design. Though higher yield was obtained with weed-free condition, comparable yield was recorded with 2 hand-weedings, pendimethalin alone or supplemented with hand-weeding owing to effective weed control. Higher yield was also obtained with 90 kg N/ha but remained at par with 75 kg N/ha, indicating better utilization of applied N.

Higher uptake of nutrients (NPK) was recorded with weed-free condition and graded doses of N. Likewise, higher oil yield was obtained with these treatments. The weed-management practices as well as nitrogen application followed in preceding Indian mustard crop did not leave any residue to affect the yield of succeeding crop of greengram adversely or favourably. However, the seed yield of greengram was significantly increased with 20 kg N/ha.

Among the various factors responsible for low yield of Indian mustard [*Brassica juncea* (L.) Czernj. & Cosson], ineffective control of weeds and inadequate fertilizations, (particularly nitrogen) are the major ones. Of the total herbicides applied to a soil, only a small amount is actually utilized in controlling weeds. The residual activity of a herbicide would be an important consideration of its use in arable farming (Bainade, 1988). The residual activity of a herbicide in conjunction with high doses of nitrogen must be ascertained for successful cropping system. Since weed management and nitrogen application to winter-season (*rabi*) Indian mustard have not yet been adequately studied on succeeding summer greengram (*Phaseolus radiatus* L.) in Vertisol of south Gujarat, a study was undertaken to find out residual effect on succeeding crop of summer greengram.

## MATERIALS AND METHODS

The field experiment was conducted at College Farm, Navasari, during the winter (*rabi*) and summer season of 1989–90 and 1990–91 on a Vertisol. The soil of experimental field was clayey, low in total N (0.050 and 0.042%), medium in available P (20.50 and 12.88 kg/ha) and high in available K (270.24 and 278.09 kg/ha), with pH 7.7 and 7.9 during 1989–90 and 1990–91

respectively. The study involved 10 weed-management practices in main plots and 3 levels of nitrogen in subplots (Table 1), replicated 3 times in split-plot design. Half dose of N and 50 kg $P_2O_5$/ha were applied at sowing and the remaining half dose of N was top-dressed at 30 days after sowing to Indian mustard crop. 'Varuna' Indian mustard was sown under irrigated condition with a row spacing of 60 cm in November and harvested in March in both the years. After harvest of the Indian mustard, the treatments of greengram were superimposed in summer with 2 levels of nitrogen (no nitrogen and 20 kg N/ha) in split-split plot design. A common dose of 40 kg $P_2O_5$/ha was applied at sowing. 'K 851' greengram was sown under irrigated condition with a row spacing of 30 cm in March and was harvested in May in both the years.

## RESULTS AND DISCUSSION

*Effect of weed-management practices*

The dominant weeds observed in Indian mustard field were *Echinochloa colonum* (L.) Link, *Digera arvensis* Forsk, *Convolvulus arvensis* L., *Trianthema monogyna* L. and *Cyperus rotundus* L.

Lowest dry weight of weeds was recorded under weed-free condition and 2 hand-weedings at 25 and 45 days after sowing, followed by herbicidal treatments compared with the weedy check and hand-weeding at 45 days or interculture at 25 days or both these treatments. This might be due to rapid growth of the Indian mustard as evident from taller plants and more number of branches/plant, which did not allow the weeds to grow vigorously due to smothering effect. Tomar and Namdeo (1991) also observed the similar trend. These treatments also recorded higher weed-control efficiency than interculturing at 25 days, hand-weeding at 45 days and interculturing at 25 days and hand-weeding at 45 days, indicating their superiority with respect to management practices. The result is in confirmation to the finding of Patel (1990). Crop–weed competition resulted in reduction of seed yield by 44.48% (Table 1). Thus weed causes severe competition with crop plants from the very beginning of the crop growth. All weed-management practices reduced the weed competition markedly. The result is in line with the finding of Ghosh and Mukhopadhyay (1981). The highest seed yield of Indian mustard was obtained under weed-free condition, but it remained statistically at par with 2 hand-weedings at 25 and 45 days, pendimethalin along with hand-weeding at 45 days and pendimethalin alone in pooled data. The results are in line with the findings of Tomar and Namdeo (1991). The seed yield is a cumulative effect of different growth and yield-attributing characters as well as higher uptake of nutrients by Indian mustard crop. Weed-free condition recorded the higher uptake of N, P and K in Indian mustard, followed by 2 hand-weedings at 25 and 45 days (Table 2). Higher yield and effectiveness of the weed-management practices to control weeds might have resulted in higher uptake of nutrients. This is in agreement with the finding of Dashora *et al.* (1990). Unweeded control showed the highest uptake of N, P and K by weeds, followed by interculturing at 25 days and hand-weeding at 45 days might be due to higher weed population and higher weed biomass production by these treatments. The lowest removal of nutrients by weed was observed in weed-free condition and 2 hand-weedings at 25 and 45 days, due to effective weed control. Dashora *et al.* (1990) also reported similar results. The oil content of seeds was not influenced appre-

**Table 1.** Dry weight of weeds (kg/ha), weed-control efficiency (%), weed-competition index (%) and seed yield of Indian mustard (kg/ha) as affected by weed-management practice and nitrogen level (mean data of 2 years)

| Treatment | Dose (kg ai/ha) | Weed dry weight (kg/ha)* | Weed-control efficiency (%) | Weed-competition index (%) | Seed yield of mustard (kg/ha) |
|---|---|---|---|---|---|
| *Weed-management practice* | | | | | |
| Pendimethalin | 1.00 | 11.21 | 84.39 | 16.38 | 1,250 |
| Pendimethalin + 1 hand-weeding (HW) at 45 days | 1.00 | 10.67 | 85.84 | 10.30 | 1,341 |
| Alachlor | 1.00 | 12.61 | 80.32 | 24.15 | 1,134 |
| Alachlor + 1 HW at 45 days | 1.00 | 11.78 | 82.81 | 20.87 | 1,183 |
| 2 HW at 25, 45 days | | 9.31 | 89.24 | 6.35 | 1,400 |
| 1 interculture (IC) at 25 days | | 17.60 | 61.68 | 34.11 | 985 |
| 1 HW 45 days | | 16.85 | 64.90 | 28.36 | 1,071 |
| 1 IC + 1 HW at 25, 45 days | | 15.85 | 68.97 | 26.89 | 1,093 |
| Weed-free condition (HW at 25, 45, 65 days) | | 8.35 | 91.31 | | 1,495 |
| Unweeded control | | 28.39 | | 44.48 | 830 |
| CD (P = 0.05) | | 0.87 | | | 308 |
| *N (kg/ha)* | | | | | |
| 60 | | 13.97 | | | 1,069 |
| 75 | | 14.26 | | | 1,192 |
| 90 | | 14.56 | | | 1,274 |
| CD (P = 0.05) | | NS | | | 113 |

*Square-root transformed value

ciably by weed-management practices, might be due to genetical character of the variety. The result is in accordance with the finding of Bhimani (1988). However, the oil yield was the highest in weed-free condition and 2 hand-weedings at 25 and 45 days might be due to higher seed yield. Bhimani (1988) also reported similar results.

*Effect of nitrogen*

Dry weight of weeds increased with an increase in N up to 90 kg/ha. This might be due to vigorous growth of the weeds with nitrogen application and higher uptake of nutrients by weeds. The N played an important role in the growth of weed plants. This revealed that increased level of N in Indian mustard also proved instrumental for enhancing the dry weight of weeds. Application of N at 90 kg/ha gave the highest seed yield of Indian mustard, which was statistically equal to 75 kg N/ha in pooled data. This might be due to the low availability of N in the soil and hence the crop responded well to its application during both the years. The finding is in accordance with that obtained by Patel (1989). Increase in N level from 60–90 kg/ha increased the N uptake by Indian mustard. Higher uptake can be attributed to favourable effect of N fertilization to

**Table 2** Uptake of nutrients by Indian mustard crop and weeds, oil content (%) and oil yield (kg/ha) and seed yield of greengram (kg/ha) as affected by weed management practice and nitrogen level (mean data of 2 years)

| Treatment | Dose (kg ai/ha) | Total uptake (kg/ha) by crop | | | Nutrient uptake (kg/ha) by weeds | | | Oil content (%) | Oil yield (kg/ha) | Seed yield of greengram (kg/ha) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | N | P | K | N | P | K | | | |
| *Weed-management practice* | | | | | | | | | | |
| Pendimethalin | 1.0 | 86.20 | 30.26 | 113.47 | 1.79 | 0.45 | 2.66 | 35.98 | 449 | 1,111 |
| Pendimethalin + 1 hand-weeding (HW) at 45 days | 1.0 | 97.63 | 33.37 | 122.35 | 1.58 | 0.35 | 2.37 | 35.93 | 481 | 1,115 |
| Alachlor | 1.0 | 75.28 | 26.23 | 105.05 | 2.43 | 0.61 | 3.39 | 36.12 | 410 | 1,117 |
| Alachlor + 1 HW at 45 days | 1.0 | 79.80 | 29.26 | 109.58 | 2.01 | 0.50 | 2.94 | 36.09 | 426 | 1,099 |
| 2 HW at 25, 45 days | | 105.92 | 35.60 | 135.46 | 1.17 | 0.25 | 1.76 | 35.88 | 502 | 1,119 |
| 1 interculture (IC) at 25 days | | 61.02 | 18.85 | 95.79 | 5.51 | 1.47 | 6.79 | 36.30 | 357 | 1,113 |
| 1 HW 45 days | | 67.36 | 22.13 | 99.54 | 4.93 | 1.26 | 6.16 | 36.23 | 387 | 1,110 |
| 1 IC + 1 HW at 25, 45 days | | 70.84 | 24.16 | 102.93 | 4.29 | 1.04 | 5.42 | 36.20 | 395 | 1,119 |
| Weed-free condition (HW at 25, 45, 65 days) | | 122.71 | 42.95 | 144.87 | 0.88 | 0.19 | 1.40 | 35.82 | 535 | 1,086 |
| Unweeded control | | 51.29 | 15.57 | 85.35 | 15.15 | 14.07 | 18.62 | 36.42 | 302 | 1,111 |
| CD (P = 0.05) | | 15.81 | 9.84 | 18.97 | 0.52 | 0.23 | 0.57 | NS | 109 | NS |
| *N (kg/ha)* | | | | | | | | | | |
| 60 | | 66.68 | 23.96 | 102.69 | 3.59 | 0.91 | 4.83 | 36.15 | 386 | 1,113 |
| 75 | | 83.27 | 28.03 | 112.31 | 3.97 | 1.01 | 5.11 | 36.10 | 430 | 1,100 |
| 90 | | 95.47 | 31.57 | 119.02 | 4.36 | 1.13 | 5.51 | 36.05 | 459 | 1,115 |
| CD (P = 0.05) | | 6.93 | 3.61 | 8.24 | NS | NS | NS | NS | 40 | NS |
| *N (kg/ha) applied to greengram* | | | | | | | | | | |
| 0 | | | | | | | | | | 1,077 |
| 20 | | | | | | | | | | 1,142 |
| CD (P = 0.05) | | | | | | | | | | 32 |

crop. Higher biomass production consequently removed more N from the soil. The result confirms the finding of Antil *et al.* (1986). The increase was 17 and 33% in P uptake with 75 and 90 kg N/ha respectively compared with 60 kg N/ha, might be due to positive effect on plant metabolism and ability of roots to absorb more P. The result confirms the finding of Reddy and Sinha (1989). The uptake of K by Indian mustard increased greatly with increasing level of N. The increase in K uptake with 75 and 90 kg N/ha was 9 and 16% respectively compared with 60 kg N/ha. Bishnoi and Singh (1982) also recorded similar result. The removal of N, P and K through weeds increased appreciably with the increase in N up to 90 kg/ha, might be due to dilution effect and also because of higher biomass production at higher level removed more nutrients from the soil. The oil content in seed of Indian mustard decreased with the increase in N from 60 to 90 kg/ha due to increase availability of N which increased the proportion of proteinous substances and consequently depressed the oil formation in seed. This is in agreement with the finding of Prihar and Tripathi (1989). Application of 90 kg N/ha increased the oil yield by 71 and 28 kg/ha over 60 and 75 kg N/ha respectively. The probable reason for increase in oil yield of Indian mustard might be owing to corresponding increase in its seed yield. The result is in accordance with Patel (1989).

*Residual effect on greengram*

There was no explicit variation in grain yield of greengram as affected by previous weed-management practices. It indicated that herbicides applied to Indian mustard were sufficiently degraded in the soil and no residue was left to affect adversely the germination and emergence of succeeding greengram. Almost similar result was reported by Bainade (1988).

Application of N to Indian mustard at different rates also did not exert any significant effect on seed yield of succeeding summer greengram. This indicated that N applied to Indian mustard had been fully utilized by it and weeds, as evident from higher uptake of N. Bainade (1988) also reported that the crop did not show any positive effect of N applied to preceding wheat crop. However, the seed yield of greengram was significantly increased with 20 kg N/ha.

## REFERENCES

Antil, R. S., Kumar, V. and Singh, N. 1986. Effect of nitrogen on yield and its uptake at different growth stages of raya (*Brassica juncea* Coss.). *Indian Journal of Agronomy* **31** (1) : 37–44.

Bainade, S. S. 1988. 'Effect of weed control methods and nitrogen levels on wheat (*Triticum aestivum* L.) and their residual effect on succeeding summer green gram crop. Ph. D. (Agriculture) Thesis, Gujarat Agricultural University, Sardar Krushinagar (unpublished).

Bhimani, P. L. 1988. 'Response of mustard (*Brassica juncea* L.) to varying irrigation schedules and weed management practices under South Gujarat conditions; M. Sc. (Agriculture) Thesis, Gujarat Agricultural University, Sardar Krushinagar (unpublished).

Bishnoi, K. C. and Singh, K. 1982. Effect of sowing time, varieties and nitrogen levels on the N, P and K uptake of raya. *Indian Journal of Agronomy* **27** (1) : 64–70.

Dashora, G. K., Maliwal, P. L. and Dashora, L. N. 1990. Weed crop competition studies in mustard (*Brassica juncea* (L.) Czernj. & Cosson). *Indian Journal of Agronomy* **35** (4) : 417–19.

Ghosh, D. C. and Mukhopadhyay, S. K. 1981. Weed control studies in rape (*Brassica campestris* L.) and economics of chemical method. *Pestology* **5** (4) : 24–28.

Prihar, S. S. and Tripathi, R. S. 1989. Influence of irrigation and nitrogen on yield, nutrient content and oil yield of mustard. *Indian Journal of Agronomy* **34** (1) : 45–49.

Patel, K. G. 1989. Response of mustard (*Brassica juncea* L.) varieties to dates of sowing and levels of nitrogen in the vertic ustochrepts of South

Gujarat. M. Sc. (Agriculture) Thesis, Gujarat Agricultural University, Sardar Krushinagar (unpublished).

Patel, S. G. 1990. Response of mustard (*Brassica juncea* (L.) Czern. and Cosson to irrigation methods and weed management practices under low land condition. M. Sc. (Agriculture) Thesis, Gujarat Agricultural University, Sardar Krushinagar (unpublished).

Reddy, B. N. and Sinha, M. N. 1989. Nutrient removal and residual fertility of mustard grown under different levels of N, P and irrigations. *Indian Journal of Agronomy* **34** (1) : 119–120.

Tomar, S. S. and Namdeo, K. N. 1991. Studies on chemical weed control in mustard. *Indian Journal of Agronomy* **36** (1) : 118–121.