Indian Journal of Agronomy **48** (2) : 120–123 (June 2003)

Dry-matter accumulation in weeds and qualitative characters of sesame (*Sesamum indicum*) as influenced by nitrogen levels and weed-control measures

B.P. SINGH, OM PRAKASH[1] AND P.K. SINGH

Department of Agronomy, Raja Balwant Singh College, Dr B.R. Ambedkar University, Bichpuri, Agra, Uttar Pradesh 283 105

Received : April 2001

ABSTRACT

A field investigation was carried out during the rainy (*kharif*) season of 1995 and 1996 at Agra, under rainfed conditions, to find out optimum level of nitrogen and effective weed-control methods in sesame (*Sesamum indicum* L.). Four levels of nitrogen (0, 30, 60 and 90 kg/ha) and 8 weed-control treatments, viz. weedy check (W_0), 1 hand-weeding 21 DAS (W_1), pre-emergence application of oxyfluorfen @ 0.15 kg/ha (W_2), W_2 + 1 hand-weeding, 21 DAS (W_3), pre-planting incorporation of fluchloralin @ 1.0 kg/ha (W_4), W_4 + 1 hand-weeding 21 DAS (W_5), pre-emergence application of Alachlor @ 1.0 kg/ha (W_6) and W_6 + 1 hand-weeding 21 DAS (W_7), were replicated 4 times in split-plot design. Among the weed-control methods tested, dry weight of weeds was reduced and weed-control efficiency increased due to the application of pre-planting incorporation of fluchloralin @ 1.0 kg/ha + 1 hand-weeding. This combination promoted seed yield, protein and oil production on hectare basis in addition to higher seed index and iodine value of oil. Unchecked weed growth lowered seed yield by 31.5%. Increasing N levels up to 60 kg N/ha increased the seed yield, protein and oil production, however, influence of N on the dry weight of weeds was not noted.

Key words : Nitrogen, Sesame, Quality parameters, Weed dry matter, Weed-control efficiency

Sesame is a rainy-season crop in Agra region and grown under rainfed conditions. The production of sesame per unit area is quite low because of weed infestation and lack of fertilizer management. Since the initial growth rate of sesame is low, it has to compete with weeds even from the early stages. Losses caused by weeds in sesame crop is reported to be as high as 50-70% (Gaur and Tomar, 1978; Ghosh and Mukhopadhyay, 1980). Hence weed infestation at different stages of crop growth plays an important role in determining the yield and quality of sesame. Another important factor responsible for the yield and quality of sesame is nitrogen. Thakur *et al.* (1998) reported higher seed yield and protein and oil yields owing to increased level of N over lower level. However, scanty information is available on this aspect in semi-arid conditions of Agra region. Hence the present study was conducted to find out the effect of weed-control measures and nitrogen levels on dry matter of weeds, seed yield and some qualitative characters of sesame in the rainfed conditions.

MATERIALS AND METHODS

A field experiment was carried out during the rainy season of 1995 and 1996 at Agricultural Research Farm of RBS College, Bichpuri, Agra. The soil was sandy loam with pH 8.9, low in available N (195.1 kg/ha), medium in P_2O_5 (26.75 kg/ha) and rich in K_2O (306.0 kg/ha). The experiment was laid out in split-plot design, keeping N levels in main plots and weed-control measures in sub-plots and replicated 4 times. The treatments comprised 4 levels of N (0, 30, 60 and 90 kg/ha) and 8 weed-control measures, viz. weedy check (W_0), 1 hand-weeding 21 DAS (W_1), pre-emergence application of oxyfluorfen @ 0.15 kg/ha (W_2), pre-emergence application of oxyfluorfen @ 0.15 kg/ha + 1 hand-weeding 21 DAS (W_3), pre-planting application of fluchloralin @ 1.0 kg/ha (W_4), pre-planting application of fluchloralin @ 1.0 kg/ha + 1 hand-weeding 21 DAS (W_5), pre-emergence application of alachlor @ 1.0 kg/ha (W_6) and pre-emergence application of alachlor @ 1.0 kg/ha + 1 hand-weeding 21 DAS (W_7). During the crop season (July-October) 441.4 mm and 485.4 mm rainfall was received during 1995 and 1996 respectively. The seeds of sesame were sown at 30 cm × 10 cm spacing on 25 July and 20 July during 1995 and 1996 respectively. Crop received 40 kg P_2O_5 and 20 kg K_2O/ha and half dose of N as per treatments as basal

Present address : [1]Research Centre, Central Soil and Water Conservation Research and Training Institute, Chhalesar, Agra, Uttar Pradesh 282 006

and half dose of N was top-dressed after 4 weeks of sowing.

The total N content in the seed was determined by using colorimetric method and protein (%) was calculated by multiplying N content with 6.25. Oil content (%) was determined by Soxhlet's apparatus using ether as solvent for oil extraction. The iodine value of oil was determined by using Honus Iodine Solution (AOAC, 1960).

RESULTS AND DISCUSSION

Weed flora

The important and predominant weeds observed were: *Cyperus rotundus, Cynodon dactylon* and *Phyllanthus niruri. Cyperus rotundus* and *Phyllanthus niruri* grew very fast and profusely in the initial crop stage and suppresses the crop growth resulting in the poor crop yields. Gaur and Tomar (1978) reported 60% reduction in sesame crop yield due to weed infestation.

Dry matter of weeds

The highest weed dry weight was recorded with unweeded check at both the crop growth stages (Table 1). All the herbicidal treatments either alone or in combination with hand-weeding significantly decreased the dry matter of weeds compared to weedy check at both the crop growth stages during both the years. Among the herbicidal treatments, pre-planting application of fluchloralin @ 1.0 kg/ha with 1 hand-weeding 21 DAS (W_5) was most effective in reducing the weed dry matter significantly compared to all other weed-control measures at both the stages of crop growth. This may most probably be due to the reason that pre-planting application of fluchloralin is quite effective in restricting the weed germination and germinated weed were removed after 21 DAS through hand-weeding. The second best treatment was the application of alachlor at pre-emergence @ 1.0 kg/ha + 1 hand-weeding in reducing the dry weight of weeds. Hence the less competition of weeds with crop and ultimately it was reflected on crop yield. Chauhan and Gurjar (1998) also reported similar results. The different levels of nitrogen could not influence the dry weight of weeds significantly. However, marginal increase in dry matter of weeds was observed with increasing level of N at both the stages of crop growth.

Weed-control efficiency

All the herbicidal as well as mechanical weed-control treatments suppressed weed population significantly compared with the control at 40 and 60 DAS. Pre-planting application of fluchloralin @ 1.0 kg/ha + 1 hand-weeding, 21 DAS had the highest weed-control efficiency, i.e. 42.65% at 40 DAS (Table 1), which clearly indicated that suppression of weeds before germination is quite essential and pre-planting incorporation of fluchloralin is effective in controlling the prevalent weed flora during the rainy season. Among herbicidal treatments the lowest weed-control efficiency (29.89%) was observed with the application of alachlor at pre-emergence @ 1.0 kg/ha. Mechanical weed control, i.e. 1 hand-weeding at 21 DAS was less effective in killing the weeds compared with chemical weed control.

Table 1. Mean total dry matter of weeds (g/m²) and weed-killing efficiency (%) at 40 and 60 DAS as influenced by nitrogen levels and weed-control measures

Treatment	Dry matter of weeds		Weed-killing efficiency (%)	
	40 DAS	60 DAS	40 DAS	60 DAS
Nitrogen (kg/ha)				
0	31.49	45.00		
30	34.59	47.86		
60	37.36	50.71		
90	39.08	52.79		
CD (P=0.05)	NS	NS		
Weed-control measure				
W_0	60.60	85.04		
W_1	36.11	49.82	24.54	21.22
W_2	33.38	44.43	30.52	27.17
W_3	31.89	42.20	31.25	28.88
W_4	33.60	46.58	31.41	27.31
W_5	26.82	36.90	42.65	36.90
W_6	32.61	50.13	29.89	27.20
W_7	30.06	40.19	37.20	32.53
CD (P=0.05)	2.52	3.39		

W_0, Weedy check; W_1, 1 hand-weeding at 3 WAS; W_2, oxyfluorfen at pre-emergence @ 0.15 kg/ha; W_3, W_2+1 hand-weeding; W_4, fluchloralin at preplanting @ 1.0 kg/ha; W_5, W_4 + 1 hand-weeding; W_6, alachlor at pre-emergence@1.0 kg/ha; W_7, W_6 + 1 hand-weeding

Seed yield and yield attributes

The mean yield of sesame increased significantly with the increase in level of nitrogen up to 60 kg/ha owing to better supply of it and consequently increased yield-contributory characters (Table 2). These findings are in accordance with those of Dwivedi and Namdev (1992) and Thakur *et al.* (1998).

Herbicides and hand-weeding either in combination or alone increased the seed yield significantly over weedy check (control) (Table 2). The highest seed yield (756 kg/ha) was recorded with the application of fluchloralin at pre-planting @ 1.0 kg/ha + 1 hand-weeding 21 DAS (W_5), which was 31.5% higher than weedy check. Treatment W_7, i.e. pre-emergence application of Alachlor @ 1.0 kg/ha + 1 hand-weeding 21 DAS also resulted in signifi-

cantly higher seed yield over oxyfluorfen and other treatments. Chauhan and Gurjar (1998) also reported higher seed yield of sesame with pre-planting application of fluchloralin compared to pre-emergence and other mechanical weed-control measures. Yield-attributory characters such as capsules/plant, seeds/capsule and seed yield/plant showed trend almost similar to that of trend seed yield (Table 2).

Table 2. Yield attributes, seed yield (kg/ha) and seed index as influenced by nitrogen levels and weed-control measures

Treatment	Capsules/ plant	Seeds/ capsule	Seed yield/ plant	Seed yield (kg/ha)	Seed index (g)
Nitrogen (kg/ha)					
0	43.80	21.86	1.78	472	2.65
30	53.02	26.83	2.25	644	2.79
60	59.60	29.85	2.41	797	2.94
90	60.85	30.92	2.62	807	3.02
CD (P=0.05)	2.99	3.46	0.24	113	0.18
Weed-control measure					
W_0	54.01	24.50	2.15	576	2.70
W_1	53.25	26.64	2.28	649	2.82
W_2	53.51	26.64	2.28	667	2.90
W_3	54.97	27.85	2.30	680	2.86
W_4	53.32	27.30	2.29	702	2.75
W_5	56:25	29.59	2.41	756	2.92
W_6	54.27	27.75	2.26	701	2.80
W_7	55.27	28.61	2.29	711	2.91
CD (P=0.05)	1.91	0.62	0.13	19	0.12

W_0, Weedy check; W_1, 1 hand-weeding at 3 WAS; W_2, oxyfluorfen at pre-emergence @ 0.15 kg/ha; W_3, W_2+1 hand-weeding; W_4, fluchloralin at preplanting @ 1.0 kg/ha; W_5, W_4 + 1 hand-weeding; W_6, alachlor at pre-emergence@1.0 kg/ha; W_7, W_6 + 1 hand-weeding

Seed index and Iodine value

Seed index increased significantly when nitrogen level increased from 0 to 30 kg N/ha in first year. Marginal increase in test weight was noted when nitrogen levels were increased from 30 to 60 and 60 to 90 kg N/ha. These results are in agreement with those of Subrahmaniyan and Arulmozhi (1999). Iodine value of the oil was also increased significantly with every increase in level of N up to 60 kg/ha.

The application of fluchloralin at pre-planting @ 1.0 kg/ha + 1 hand-weeding keeping at par with pre-emergence application of alachlor @ 1.0 kg/ha + 1 hand weeding 21 DAS gave bolder size of sesame seeds as compared to other weed-control measures and weedy check. Significantly higher iodine value was recorded under W_5 treatment compared to all other treatments except W_7 in first years.

Protein and oil content and their production

Protein content and production increased significantly with increasing level of nitrogen up to 60 kg/ha. Further increase in N from 60 to 90 kg N/ha could not influence the protein production significantly. The oil percentage

Table 3. Protein and oil content in seed and their production/ha and iodine value of sesame as influenced by nitrogen levels and weed-control measures

Treatment	Protein content (%)	Oil (%) in seed	Protein production (kg/ha)	Oil production (kg/ha)	Iodine value
Nitrogen (kg/ha)					
0	17.59	37.08	87.3	175.4	111.68
30	20.71	40.20	137.4	259.2	129.18
60	23.73	40.77	193.3	326.2	145.33
90	23.74	40.94	196.8	331.6	146.07
CD (P=0.05)	2.84	2.59	43.6	61.6	15.92
Weed-control meaure					
W_0	18.18	37.84	115.3	216.7	119.38
W_1	20.81	39.11	143.2	256.3	130.72
W_2	21.12	39.44	147.7	265.2	130.04
W_3	21.57	40.15	152.5	275.1	135.58
W_4	21.62	39.49	159.0	279.9	133.00
W_5	23.57	41.11	186.1	312.3	143.19
W_6	22.01	40.57	163.3	238.1	133.62
W_7	22.19	40.66	164.6	291.7	134.46
CD (P=0.05)	0.60	0.89	20.9	30.7	6.62

W_0, Weedy check; W_1, 1 hand-weeding at 3 WAS; W_2, oxyfluorfen at pre-emergence @ 0.15 kg/ha; W_3, W_2+1 hand-weeding; W_4, fluchloralin at preplanting @ 1.0 kg/ha; W_5, W_4 + 1 hand-weeding; W_6, alachlor at pre-emergence@1.0 kg/ha; W_7, W_6 + 1 hand-weeding

increased with first increment in N level, i.e. 0–30 kg N/ha, while oil yield increased steadily due to increase in N level up to 60 kg N/ha (Table 3). This is in conformity with the findings of Ghosh and Patra (1994) and Thakur *et al.* (1998).

Manual and herbicidal treatments either alone or in combination increased the protein and oil content of the sesame seeds and their production on hectare basis as compared to unweeded check (Table 3). Oil and protein percentage in seeds and their production/ha were higher in plot treated with fluchloralin at pre-planting @ 1.0 kg/ha + 1 hand-weeding 21 DAS and this was considerably superior to all other treatments in these respect. The higher production may mainly be attributed to its higher yield potential and higher contents in the seeds due to minimum competition between crop and weed plants for resources. These results corroborate the findings of Sharma and Chauhan (1995).

The sesame crop may be fertilized @ 60 kg N/ha and for effective control of weeds, pre-planting incorporation of fluchloralin @ 1.0 kg/ha + 1 hand-weeding 21 DAS should be done for getting higher seed yield and oil and protein production per unit area.

REFERENCES

AOAC. 1960. *Method of Analysis of the Association of Official Agricultural Chemists*. edn 9. Horomitz, W. (Ed.). Association of Official Agricultural Chemists, Washington D.C.

Chauhan, D.V.S. and Gurjar, B.S. 1998. Mechanical and chemical weed control in sesame (*Sesamum indicum*). *Indian Journal of Agronomy* **43** (3) : 480–483.

Dwivedi, V.D. and Namdev, K.N. 1992. Response of sesame (*Sesame indicum*) to nitrogen and phosphate. *Indian Journal of Agronomy* **37**(3) : 606–607.

Gaur, B.L. and Tomar, D.S. 1978. Chemical weed control in sesame. *Indian Journal of Agronomy* **23**(1) : 71.

Ghosh, D.C. and Mukhopadhyay, S.K. 1980. Effect of plant density and fertility levels on productivity and economics of summer sesame (*Sesamum indicum*). *Indian Journal of Agronomy* **25**(1) : 71–75.

Ghosh, D.C. and Patra, A.K. 1994. Effect of plant density and fertility levels on productivity and economy of summer sesame (*Sesamum indicum*). *Indian Journal of Agronomy* **39**(1) : 71–75.

Sharma, M.L. and Chauhan ,Y.S. 1995. Cultural and chemical weed control in Indian mustard (*Brassica juncea*). *Indian Journal of Agronomy* **40** (2) : 235–238.

Subrahmaniyan, K. and Arulmozhi, N. 1999. Response of sesame (*Sesamum indicum*) to plant population and nitrogen under irrigated condition. *Indian Journal of Agronomy* **44** (2) : 413–415.

Thakur, D.S., Patel, S.R. and Nageshwar, Lal. 1998. Yield and quality of sesame (*Sesamum indicum*) as influenced by nitrogen and phosphorus in light textured Inceptisols. *Indian Journal of Agronomy* **43** (2) : 325–328.