Indian Journal of Weed Science 40 (1&2) : 22-25, 2008

Influence of covering materials on weed control and yield of chickpea

Jay G. Varshney and Lalit Kumar[1]
National Research Centre for Weed Science (ICAR), Jabalpur (Madhya Pradesh)
[1]Division of Crop Production, Indian Institute of Pulses Research, Kalyanpur, Kanpur (Uttar Pradesh)
E mail: varshneyjg@gmail.com

ABSTRACT

A study was conducted at Indian Institute of Pulses Research, Kanpur to determine the effect of different farm litters/covering materials/mulches for various durations on weed infestation and seed yield in rainfed chickpea. Results revealed that *Azadirachta indica* (neem) leaves applied at 5 t/ha suppressed density of common lambsquarters, purple nut sedge and scarlet pimpernel and gave an over all mean weed smothering efficiency (WSE) of 45.7% and 76.0% more seed yield (1609 kg/ha) of chickpea in comparison of no cover applied. Covering of transparent/black polythene sheet (0.4 mm) resulted in low density and biomass of such weeds attaining 57.7% mean WSE and 116% more mean seed yield (1962 kg/ha) of chickpea in comparison of check (906 kg/ha). Other materials such as pigeonpea (*Cajanus cajan* (L) Millep) or mango (*Mangifera indica* L.) leaves or rice straw also significantly suppressed weed intensity and enhanced yield to a variable extent. Among different weed flora, lambsquarters caused significant reduction in seed yield of chickpea, while among yield components, test weight was highly influenced due to weed infestation causing yield reduction. The density and biomass of weeds reduced with progressive increase in duration of covering mulches. Covering duration of mulches for 60 days proved significantly better over 30 days duration.

Key words: Covering materials, Farm litters, Farm wastes, Mulches, Tree litters, Weed management

Chickpea (*Cicer arietinum* L.) is one of the most widespread crops grown under reduced moisture conditions in India. The weeds in winter season tend to offer severe competition and cause drastic yield reduction up to the extent of 75% in chickpea (Balyan and Bhan 1984, Singh and Singh 1992). Under the scarce moisture conditions, the competition offered by weeds to other crops for moisture and nutrients has been a matter of great concern to the farmers. Common lambsquarters (*Chenopodium album* L.) is one of the most predominating weeds in chickpea affecting its productivity in India. Covering materials offer distinct advantages to crop as these do not allow the weed seeds to germinate, reduce evapo-transpiration and make available the moisture and nutrients to crop plants. Use of covering materials in weed management appears to be a low cost, eco-friendly technique. Crutchfield *et al*. (1986) have reported that weed populations are controlled with wheat straw in maize crop. Hepperly and Diaz (1983) also reported that pigeon pea leaf litter significantly controlled the weed population for two months. More information is necessary to ensure that use of such materials particularly under moisture stress conditions become a viable and sustainable option for farmers growing crops under resource constraint situations prevailing in pulses farming in the sub-continent. The objective for this study was to determine if covering materials would suppress weed growth, reduce crop weed competitiveness and enhance yield along with reduction in the need of herbicidal demand.

MATERIALS AND METHODS

An experiment was conducted at experimental farm of Indian Institute of Pulses Research, Kanpur in winter season during two consecutive years of 1995-96 and 1996-97. The soil of the experimental field was sandy loam in texture, poor in organic C, medium in available P and high in available K. The pH of soil was 7.35. The treatment combinations comprised of seven covering materials *viz.*, transparent polythene (0.4 mm), black polythene (0.4 mm), Mango (*Mangifera indica* L.) leaves, neem (*Azadirachta indica* A. Juss) leaves, pigeon pea (*Cajanus cajan* L. Millsp.) leaves and rice straw each at 5 t/ha, no cover and 3 covering duration *viz.*, 30, 60, 90 days were arranged in a randomized block design with three replications. The polythene pieces and air-dried leaves/straw were spread in the inter row spaces immediately after sowing of chickpea crop. The experimental field was prepared by harrowing twice with disc harrow followed by two tilling by cultivator. Planting was done after last tilling operation. Recommended dose of fertilizers (18:46:40

kg N: P_2O_5: K_2O/ha) was applied at the time of sowing. Sowing was done with the help of hand hoe by opening the furrow at 30 cm apart and placing the seed at 10 cm in the furrows in 3rd week of November and last week of October in 1995 and 1996, respectively. The plot size was 3.6 x 4.0 m^2. The above ground portion of weeds was clipped manually after placing the quadrate of 0.25m^2 randomly at two places in each plot when lambsquarters reached the inflorescence stage. Lambquarters (*Chenopodium album* L.), purple nut sedge (*Cyperus rotundus* L.) and scarlet pimpernel (*Anagallis arvensis* L) were recorded as the predominating weeds. The weed smothering efficiency (WSE) was computed by following formula:

$$WSE\,(\%) = \frac{\text{Weed biomass in weedy check} - \text{Weed biomass in particular treatment}}{\text{Weed biomass in weedy check}} \times 100$$

Weed density data were subjected to square root transformation before statistical analysis to reduce the influence of non-normal data distributions. Statistical significance of treatment differences was studied by 'F' test at 5% level.

RESULTS AND DISCUSSION

Effect of covering materials on weed dynamics

C. album was the predominant weed flora recorded from the experimental site followed by *C. rotundus* and *A. arvensis*. Few plants of *C. arvensis, S. arvensis* and *F. parviflora* were also recorded (data not presented in the paper).

Chenopodium album

Density and biomass of *C. album* significantly influenced due to different covering materials at the time of crop harvest (Table 1). Amongst the farm litters, neem leaves reduced weed mean density by 62.1% followed by pigeonpea, mango leaves and straw leaves by 58.3, 55.5 and 47.6%, as against 67.5% by black polythene over check (no cover). Similarly, a reduction in weed biomass was observed by 49.5, 47.5, 41.9 and 34.9% in case of neem, pigeonpea, mango leaves and straw in comparison to 60.0 and 61.4% in black and transparent polythene over check. It was found that transparent polythene suppressed population of *C. album* by 70 and 80% over check in first and second year, respectively. However, there was no significant variation in either the black or transparent ploythene sheets in this context.

Cyperus rotundus

Various covering materials significantly influenced the density and biomass of nutsedge during both the years (Table 1). In general, density and biomass during second year was less in comparison to first year. Amongst the farm litters, the maximum reduction in the density of this weed was 37.4% in neem leaves followed by 34.6, 33.0, and 23.6% in pigeonpea, mango, straw cover in comparison of 44% in black polythene. However, the mean biomass reduction of this weed was in the range of 4.9 - 14.0% by different covering materials. Transparent polythene sheet registered lowest density (40 and 35/m^2) and biomass (9.93 and 9.35 g/m^2) in first and second year, which was statistically at par in density with black polythene. Transparent polythene recorded 31, 39% less density and 29, 25% less biomass, in comparison to no cover in first and second year, respectively.

Table 1. Effect of covering materials and their duration on weed density and biomass of different weed flora

Treatment	*C. album*				*C. rotundus*				*A. arvensis*			
	Density (no./m^2)		Biomass (g/m^2)		Density (no./m^2)		Biomass (g/m^2)		Density (no./m^2)		Biomass (g/m^2)	
	1995-96	1996-97	1995-96	1996-97	1995-96	1996-97	1995-96	1996-97	1995-96	1996-97	1995-96	1996-97
Covering materials												
Transparent polythene	7.10(50)	5.50 (30)	26.30	22.20	6.36(40)	6.00(35)	9.93	9.35	6.50 (42)	6.02 (36)	22.05	19.00
Black polythene	7.90(62)	6.45 (41)	27.22	22.90	7.35(54)	6.90(48)	11.32	10.00	6.98 (48)	6.02 (36)	23.77	19.22
Mango leaves 5t/ ha	8.85(78)	7.95 (63)	38.50	34.45	7.35(54)	8.00(65)	11.45	11.25	8.40 (70)	7.25 (52)	32.86	24.45
Neem leaves 5t/ ha	8.40(70)	7.10 (50)	35.06	28.30	7.78(60)	7.38(54)	12.12	11.20	6.96 (48)	6.80 (46)	24.00	23.77
Pigeon pea leaves 5t/ ha	8.85(78)	7.35 (54)	36.90	28.95	7.90(62)	7.78(60)	12.25	11.28	8.15 (66)	6.80 (46)	29.90	24.05
Rice straw 5t/ ha	8.88(83)	9.12 (83)	41.42	40.38	8.20(67)	8.50(72)	12.70	11.83	8.38 (70)	8.25 (68)	34.10	30.14
No cover	12.90(167)	12.25 (150)	62.25	63.30	9.20(84)	9.90(98)	14.00	12.42	10.50 (110)	10.15(103	48.35	42.11
LSD (P=0.05)	2.30	2.13	3.42	3.48	1.62	1.47	1.83	1.87	1.74	1.82	3.34	3.10
Covering period (days)												
30	11.66(136)	11.02(121)	55.50	58.45	9.61(92)	9.20(84)	13.44	11.88	10.17 (103)	9.35 (87)	45.21	32.02
60	8.63(74)	7.10 (50)	31.48	23.34	6.50(42)	6.18(38)	9.85	9.25	7.25 (52)	6.67 (44)	24.97	23.00
90	6.52(42)	5.61 (31)	27.75	21.26	5.52(30)	4.73(22)	8.63	8.90	6.29 (39)	5.96 (35)	21.95	19.32
LSD (P=0.05)	2.13	1.97	3.48	3.54	1.80	1.68	1.95	1.90	1.66	1.63	3.22	3.42

Figures in parenthesis are original values

Anagallis arvensis

The infestation of *A. arvensis* was also significantly influenced by different covering materials (Table 1) at harvest. Amongest the covering materials, neem leaves recorded density and biomass equal to that of transparent/ black polythene sheet in both the years (except in second year for biomass). Other farm litters recorded decline in mean density by 47.9, 43.3, 35.8% and 36.6, 40.3, 29.0 in mean biomass by mango, pigeonpea leaves and rice straw as against 56.3 and 47.2% due to neem leaves. There was, however no significant variation in both black or transparent polythene covers as regards to density and biomass of this weed. Transparent polythene had recorded 61.8 and 65.0% less density and 54.4 and 55.0% less biomass of this weed in comparison to check in first and second year, respectively.

Effect of covering duration on weed dynamics

As far as covering duration is concerned, the density (42 and 31/m) and biomass (27.75 and 21.26 g/m^2) of *C. album* was minimum and at 90 days which was, however at par with 60 days stage but significantly superior over 30 days stage. In case of purple nut sedge, there was no significant variation in 60 and 90 days duration in density and biomass of nut sedge in both the years. However, 60 days covering period significantly reduced density and biomass of nut sedge in comparison to 30 days in both the years. In scarlet pimpernel, at 90 days covering duration significantly lowered density (39 and 35/m^2) and biomass (21.95 and 19.32 g/m^2) of this weed was recorded as compared with 30 and 60 days duration during both the seasons. However, the differences in density and biomass between 90 and 60 days duration were practically found non significant (Table 1).

Effect on seed yield and yield components

Different covering materials and their duration had significantly influenced chickpea seed yield (Table 3). Maximum seed yield was observed in the plots of transparent polythene (1896 and 2028 kg/ha) followed by black polythene (1727 and 1985 kg/ha) during both the years. Neem leaves cover performed significantly better in enhancing seed yield of chickpea over check though no significant variation was recorded in different leaves from yield point of view. Sachan *et al*. (1997) also found a significant increase in yield of rainfed mustard with mulch of paddy straw. Among the yield components, number of pods/plant and 100 - seed weight were found significantly influenced by different covering materials. Transparent polythene caused mean increase in number of pods/plant by 42.6% and 100 seed weight by 36.5% over no cover. There was no significant variation in number of pods/plant and 100- seed weight due to black polythene and *neem* leaves (Table 2).

As far as covering duration is concerned, there was no significant variation in 60 and 90 days however, 60 days period caused a significant increase in number of pods/ plant and 100 - seed weight over 30 days duration.

Weed smothering efficiency (WSE)

Transparent polythene registered highest WSE of 56.21 and 59.19% followed by black polythene (52.31 and 57.33%) during first and second year, respectivly (Table 3). Amongst the farm litters, the maximum WSE was recorded with neem leaves (44.36 and 46.99%) followed by pigeon pea (38.51 and 46.99%) and mango (35.15 and 41.13%) leaves in first and second year, respectively. In case of covering duration, highest WSE

Table 2. Effect of covering materials and their duration on yield attributing characters of chickpea

Treatments	Pods/plant		Grains/pod		100 - seed weight (g)	
	1995-96	1996-97	1995-96	1996-97	1995-96	1996-97
Covering materials						
Transparent polythene	55.4	56.1	1.8	1.9	23.54	24.05
Black polythene	50.9	50.8	1.7	1.8	21.92	22.00
Mango leaves 5 t/ha	37.9	44.2	1.6	1.7	17.78	18.04
Neem leaves 5 t/ha	46.4	48.0	1.7	1.7	18.75	20.12
Pigeon pea leaves 5 t/ha	41.3	45.3	1.7	1.7	18.05	19.35
Rice/wheat straw 5 t/ha	36.2	37.1	1.5	1.6	16.92	17.45
No cover	31.7	32.3	1.5	1.5	15.15	15.08
LSD (P=0.05)	4.9	5.0	NS	NS	2.83	2.89
Covering period (days)						
30 days	38.3	37.9	1.6	1.7	19.72	21.30
60 days	48.9	47.8	1.7	1.7	22.63	23.85
90 days	50.0	50.3	1.7	1.8	23.00	23.94
LSD (P=0.05)	4.9	4.8	NS	NS	2.73	2.76

Table 3. Effect of covering materials and their duration on weed smothering efficiency (WSE) and seed yield of chickpea.

Treatment	Weed smothering efficiency (%)		Seed yield of chickpea (Kg/ha)		
	1995-96	1996-97	1995-96	1996-97	Mean
Covering material					
Transparent polythene	56.21	59.19	1896	2028	1962
Black polythene	52.31	57.33	1727	1985	1856
Mango leaves 5 t/ha	35.15	41.13	1450	1545	1498
Neem leaves 5 t/ha	44.36	46.99	1608	1610	1609
Pigeon pea leaves 5 t/ha	38.51	46.35	1400	1580	1490
Rice straw 5 t/ha	28.97	29.97	1194	1492	1343
No cover	-	-	835	977	906
LSD (P=0.05)	-	-	410	402	-
Covering period (days)					
30	8.18	12.23	1312	1465	1389
60	47.46	52.84	1428	1820	1624
90	53.76	57.95	1693	1978	1836
LSD (P=0.05)	-	-	336	362	-

up to the extent of 64.0 and 64.0% by 90 days over 60 and 30 days duration was recorded during 1995-96 and 1996-97.

It may be concluded from the above study that covers when applied in rainfed crop of chickpea, reduce crop weed competition by suppressing weeds effectively and increase yield. Use of farm wastes or tree litters such as neem leaves *etc,* suppresses weeds effectively and increases yield without any extra cost involved.

ACKNOWLEDGEMENTS

The help and financial support provided by ICAR by sanctioning the project entitled "Nut sedge management in field crops with particular emphasis in pulses" is grately acknowledged. The author is thankful to the Director, Indian Institute of Pulses Research, Kanpur for providing the necessary facilities for conducting the study.

REFERENCES

Balyan RS and Bhan VM. 1984. Promising herbicides for weed control in chickpea (*Cicer arietinum* L.*). Indian Journal of Weed Science* **16** (2) : 69-75

Crutchfield DA, Wicks GA and Burucide DC. 1986. *Weed Science* 34: 110-114. cf. *Allelopathy in crop production*. Narwal SS (ed.), Scientific Publishers, Jodhpur.

Hepperly PR and Diaz M. 1983. *Journal of Agriculture University* Puerto Rico, 67 : 453-463. cf. *Allelopathy in Crop Production* Narwal SS (ed.), Scientific Publishers, Jodhpur.

Sachan SS, Singh RK and Koshta SK. 1997. Effect of nitrogen levels, row spacing and moisture conservation practices on rainfed mustard on eroded soil. *Indian Journal of Soil Conservation* **25** (1): 84-85.

Singh Govindra and Singh D. 1992. Weed crop competition studies in chickpea (*Cicer arietinum* L.). *Indian Journal of Weed Science* **24** (1 & 2) : 1- 5.