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Effect of *subabul* (*Leucaena leucocephala*)-live bund on growth and yield of companion crop of sunflower (*Helianthus annuus*)

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ABSTRACT

A field experiment conducted during the winter (*rabi*) seasons of 1988–89 and 1989–90 to study the effect of stubble height of *subabul* [*Leucaena leucocephala* (Lam.) de Wit.] on growth and yield of companion crop of sunflower (*Helianthus annuus* L.) under rainfed condition at Bijapur. Significantly higher yield of sunflower was obtained with *subabul* cut close to ground level (11.45 and 9.56 q/ha) than 30 cm (10.43 and 8.68 q/ha) and 60 cm (8.42 and 6.92 q/ha) during 1988–89 and 1989–90 respectively. A significant yield reduction of sunflower was observed till 27 m distance from the *subabul*-live bund. The highest net income was recorded with the *subabul* cut at 30 cm stubble height (Rs 5,468 and 4,314/ha during 1988–89 and 1989–90 respectively). Reduction in the yield was attributed to competition for moisture, nutrient and light interception close to *subabul*-hedge row.

The northern dry zone of Karnataka is characterized by low, erratic and uncertain rainfall with prolonged dry spells. A large proportion of soils in the region is subjected to severe soil erosion due to gently sloping terrain. Both soil and water losses in dryland areas are inseparable and must be managed efficiently to maintain the productivity of the soil for successful crop production. In the state, though contour bunding is widely practiced as a soil and water-conservation measure, contour bunds are not stable in black soils due to cracking nature of the soil. Further, bunds occupy considerable land area and are expensive. The studies made elsewhere have shown that the vegetative barrier across the slope has promise not only for soil and water conservation but also for better utilization of bund area and is a low-cost technique. It is, however, reported that live vegetative bunds compete the adjacent crops. Under such circumstances, the optimization of management practices for reducing competitive effect were undertaken in the present investigation.

MATERIALS AND METHODS

The field experiment was conducted at Jaipur during the winter (*rabi*) seasons of 1988–89 and 1989–90. The experiment was laid out in randomized block design with 3 replications. There were 12 treatment combinations which included 3 cutting heights of *subabul* or leucaena [*Lecuaena leucocephala* (Lam.) de Wit.] (cut close to ground level, 30 cm and 60 cm) and 4 distances from its live bund (1.35, 2.70, 4.05 and 5.4 m). The experimental site was clay (52.00% clay), with pH 7.90. The available nitrogen, phosphorus and potassium were 105.0, 15.24 and 396.0 kg/ha respectively. Two rows of *subabul* were planted 4 years

ago along the contour lines at a distance alleys at 45 cm × 20 cm spacing on 20 September and 21 September during 1989--89 and 189--90 respectively. The recommended fertilizer dose of 50, 25 and 25 kg of N, P and K/ha respectively was applied at the time of sowing. The rainfall during September, October, November, December, January and February in 1988–89 was 267, 8, 0, 73, 0 and 0 mm respectively, with rainy days of 14, 10, 0, 2, 0 and 0; and in 1989--90 it was 393, 7.5, 15, 32, 5 and 0 mm, with rainy days of 15, 1, 1, 1, 1, and 0. The crop was harvested on 21 December and on 21 December during 1988–89 and 1989–90 respectively.

RESULTS AND DISCUSSION

The live bunds had substantial effect on growth and yield of sunflower. All the stubble heights had suppressing effect on sunflower and the degree of suppression increased with successive increase in stubble height from the ground level up to 60 cm. Among the stubble heights, the stubble cut close to ground level recorded significantly higher seed yield of sunflower (11.48 and 9.56 q/ha) than that of stubble heights of 30 cm (10.43 and 8.68 q/ha) and 60 cm (8.42 and 6.92 q/ha) during 1988–89 and 1989–90 respectively. The reduction in seed yield of sunflower with cut at 30 and 60 cm stubble heights was 8.9 and 26.5% respectively. The higher yield at cut lose to ground was mainly due to better availability and utilization of light, moisture and nutrients.

The reduction in seed yield of sunflower was due to low values of diameter, seed wight/plant seeds/head and 1,000-seed weight under 60 cm-stubble height (Table 2) Similarly, there was a significant reduction in growth components like plant height, leaf area/plant and total dry-matter production/ plant (Table 1). The competition for light is supported by the observation on light : transmission ratio, moisture status and nutrient uptake by the plants. The lower interception of light with higher cutting

Table 1. Growth components of sunflower as influenced by stubble height of *subabul* and distance from its live bund

Treatment	Plant height (cm) at harvest		Leaf area/plant (cm^2) at 60 days*		Total dry-matter production (g/plant) at harvest	
	1988–89	1989–90	1988–89	1989–1990	1988–89	1989–90
*Subabul *stubble height (cm)*						
0	117.65	110.06	865	710	40.61	36.95
30	107.23	99.79	782	699	37.02	33.55
60	86.50	78.84	637	557	29.87	26.73
CD (P = 0.05)	12.92	11.43	90	82	4.34	3.99
Distance from live bunds (m)						
1.35	84.99	78.56	626	550	29.34	26.41
2.70	99.11	91.92	720	644	34.21	30.90
4.05	110.98	103.30	817	722	38.32	34.66
5.40	120.98	111.15	885	786	41.46	37.67
CD (P = 0.05)	14.34	13.19	104	95	5.02	4.62

*Days after sowing

Table 2. Yield components and yield of sunflower, total green-matter, yield of *subabul* and net income in sunflower as influenced by stubble height of *subabul* and distance from the *subabul*

Treatment	Diameter of head (cm)		Seed weight/ plant (g)		Seeds/ head (No.)		1,000-seed weight (g)		Seed yield (q/ha)		Total green-matter yield of *subabul* (q/ha)		Net income (Rs/ha)	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Subabul stubble height (cm)														
0	8.14	7.18	5.59	4.66	163.75	143.75	34.61	32.56	11.45	9.56	35.14	30.11	5,366	4,128
30	7.49	7.52	5.10	4.24	149.08	130.75	31.55	19.52	10.43	8.68	60.04	55.16	5,468	4,314
60	5.99	5.19	4.11	3.37	119.67	104.00	25.45	23.53	8.42	6.92	64.74	58.85	4,416	3,408
CD (P = 0.05)	0.86	0.72	0.57	0.52	16.88	15.53	3.63	3.34	1.02	0.94				
Distance from live bunds (m)														
1.35	5.88	5.13	4.04	3.33	117.22	102.67	25.00	23.24	8.28	6.84				
2.70	6.86	6.00	4.71	3.89	138.00	120.33	29.15	27.20	9.65	8.00				
1.05	7.68	6.73	5.27	4.37	154.67	135.00	32.66	30.55	10.80	8.97				
5.40	8.31	7.32	5.71	4.76	166.78	146.67	35.33	33.15	11.69	9.75				
CD (P = 0.05)	1.00	0.92	0.66	0.61	19.50	4.20	4.20	3.86	1.17	1.08				

A, 1988–89; B, 1989–90

Table 3. Soil moisture, light-transmission ratio and nitrogen uptake in sunflower as influenced by stubble height of *subabul* and distance from live bund

Treatment	Soil moisture (cm) (at 0–60 cm depth) at harvest		Light-transmission ratio (%) at 60 DAS		N uptake (kg/ha) at harvest	
	1988–89	1989–90	1988–89	1989–90	1988–89	1989–90
Subabul-*stubble height (cm)*						
0	14.77	13.27	89.70	89.25	35.02	30.96
30	13.83	12.31	70.71	69.67	29.67	25.87
60	12.07	10.40	20.03	19.75	20.00	17.36
CD (P = 0.05)					2.49	2.29
Distance from live bunds (m)						
1.0	12.67	11.24	20.38	19.20	22.08	18.94
2.0	14.33	13.07	69.59	69.70	27.87	21.78
3.0	15.13	14.00	90.52	89.50	30.76	26.83
CD (P = 0.05)					3.31	3.00

DAS, Days after sowing

height was mainly due to profuse foliage, as there was more surface area on the stem of *subabul* for initiation of buds and branches, which in turn reduced the growth of sunflower near the live bund due to shade. Kang *et al.* (1981) reported that shade is the main factor affecting the yield of maize, when maize is grown in association with hedge rows of *subabul*.

A significant reduction in the seed yield of sunflower was noticed when it was grown at 1.35 m distance (8.28 and 6.84 q/ha during 1988–89 and 1989–90 respectively) and at 2.70 m distance (9.56 and 8.00 q/ha during respective seasons) from the live bund of *subabul* compared with 5.4 m distance. Srivastava (1986) and That (1988) also reported decreased yield of sunflower near the tree line. The higher yield obtained at distances greater than 2.7 m is mainly due to lesser competition between the *subabul* and sunflower for moisture, nutrients and light (Table 3). The decrease in yield of sunflower was 29.2, 17.5 and 7.6% at 1.35, 2.70 and 4.05 m distances respectively from the live bund of *subabul*.

The growth and yield components of sunflower like plant height, leaf area, total dry-matter production/plant (Table 1) and the head diameter, seeds/plant, 1,000-grain weight and seed weight/plant, which determine the yield, also increased with increase in the the distance from the live band (Table 2).

The moisture status increased with increase in distance from the live bund of *subabul*. Similar results were obtained by Srivastava (1986) and That (1988). Similarly, nutrient stress is indicated by lower rate of nutrient uptake by sunflower near the live bund (Table 3).

Though the yield of sunflower was reduced with the cut at 30 cm-stubble height of *subabul*, the reduction in grain yield was compensated by the green-forage yield (60.04 q/ha) of *subabul* and resulted in higher net income (Rs 5,468/ha). However, the yield of sunflower was more with cut

close to the ground level, the net income (Rs 5,366/ha) was less due to lower green-forage yield of *subabul*. With further increase in stubble height (60 cm), the reduction in yield of sunflower was not compensated by higher forage yield of *subabul*.

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