

RESPONSE OF *KHARIF* MUNGBEAN (*Vigna radiata*) TO PRECEDED SUMMER SUNFLOWER UNDER VARIED SOWING DATES

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Abstract: Field experiment was conducted during *kharif* season of 2014 and 2015 at Main Agricultural Research Station, UAS, Dharwad to know the response of *kharif* mungbean (*Vigna radiata*) to preceded summer sunflower under varied sowing dates. Pooled data indicated that significantly higher seed yield of mungbean was obtained in *kharif* mungbean preceded by summer fallow land (CS₂-556 kg ha⁻¹) compared to *kharif* mungbean preceded by summer sunflower (CS₁-397 kg ha⁻¹). Among the sowing dates, the crop sown on D₁ (June 28th - after three weeks of harvest of summer sunflower) recorded significantly higher seed yield (819 kg ha⁻¹) than other sowing dates. The interaction effect of *kharif* mungbean preceded by summer fallow at the date of D₁ (CS₂D₁- 971 kg ha⁻¹) recorded significantly higher yield over other interactions.

Keywords: Allelopathy, sunflower, mungbean, sowing dates.

Introduction: Allelopathy plays an important role in the agroecosystems leading to a wide array of interactions between crop-crop, crop-weed and tree-crops. Generally, these interactions are harmful to the receiver plants but provide a selective benefit to the donor. Sunflower (*Helianthus annuus* L.) being thermo and photo-insensitive, it can be grown round the year in sub-tropics and fits well in the multiple cropping systems. In Karnataka, sunflower grown in an area of 4.30 lakh hectare and is mainly grown in Northern Karnataka in medium to deep black soils and it comprises the districts of Bagalkot, Belgaum, Bijapur, Dharwad, Gadag, Gulbarga, Koppal, Raichur and Yadgir. In some pockets of these districts sunflower is grown in summer also. In sunflower species several substances with allelopathic properties such as phenolic compounds, diterpenes and triterpenes have been isolated and chemically characterized (Macias *et al.*, 1993). Crop residues of sunflower also produce harmful effects on the germination and growth of subsequent crops (Macias *et al.*, 1999).

Mungbean (*Vigna radiata* L. Wilczek) is one of the important pulse crops of Karnataka with an area of 3.69 lakh ha. It is observed that there is reduction in the yield of *kharif* mungbean by the residual effect of summer sown sunflower. To address the issue of residual effect of summer sunflower on *kharif* mungbean crop, to know the per cent yield reduction in *kharif* mungbean by the residual/allelopathic effect of summer sunflower and optimization of interval between sowing of mungbean and harvesting of sunflower to have minimum allelopathic effect, this study was conducted.

Material and methods: A field experiment was conducted during *kharif*- 2014 and 2015 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad (Karnataka) which situated at 15°26' N latitude, 75°01' E longitude and at an altitude of 678 m above mean sea level. The soil of experimental site was medium black clay soil, with

low nitrogen (253.4 kg ha⁻¹), medium phosphorous (27.7 kg ha⁻¹) and high potash (325.84 kg ha⁻¹). Experiment was laid out in a split plot design replicated thrice with different cropping system in main plots and sowing dates in sub plots. Two cropping systems (CS₁-*kharif* mungbean preceded by summer sunflower and CS₂-*kharif* mungbean preceded by summer fallow) were used in the study and sowing was done as per sowing date treatments [D₁-28th June (three weeks after harvest of sunflower), D₂-5th July (four weeks after harvest of sunflower), D₃-12th July (five weeks after harvest of sunflower) and D₄-19th July (six weeks after harvest of sunflower)]

Results and discussion:

Effect of cropping systems on growth and yield of mungbean: Based on pooled analysis, *kharif* mungbean preceded by summer fallow land recorded significantly higher seed yield (556 kg ha⁻¹) than *kharif* mungbean preceded by summer sunflower (397 kg ha⁻¹). The increase in seed yield of CS₂ over CS₁ was to an extent of 28.60 per cent. This increase was due to increase in the growth and yield parameters of mungbean in CS₂ which was resulted in significantly higher number of pods (11.84) than CS₁ (9.20). The increase in number of pods per plant of CS₂ over CS₁ was to an extent of 22.30 per cent (Table 2). The yield parameters were directly correlated with the growth parameters. *Kharif* mungbean preceded by summer fallow land (CS₂) recorded significantly higher plant height (51.36 cm) and number of branches per plant (8.26) as compared to *kharif* mungbean preceded by summer sunflower (39.59 and 7.91, respectively) (Table 2). This was mainly due to allelochemicals which suppressed the photosynthetic absorption of carbon dioxide, and was resulted into stunted growth of mungbean. The phytotoxicity of sunflower biomass persisted in soil upto four to five weeks after soil incorporation. These results indicated that sunflower plants released and accumulated the phytotoxins in the soil which adversely affected the succeeding test

crop. These results are corroborating with the results of Narval *et al.*, 1999.

Effect of sowing dates on growth and yield of mungbean: Among sowing dates, mungbean crop sown after three weeks of harvest of sunflower (28th June) recorded significantly higher seed yield (819 kg ha⁻¹) when compared to crop sown after four, five and six weeks of harvest of sunflower (D₂-491 kg ha⁻¹, D₃-335 kg ha⁻¹ and D₄-260 kg ha⁻¹, respectively). The crop sown after three weeks after harvest of sunflower registered 40.05, 59.10 and 68.25 per cent higher seed yield over four, five and six weeks after harvest of sunflower, respectively. The higher seed yield obtained in early sown crop is attributed to higher soil moisture during cropping period. This coincides with the flowering and pod formation stage of early sown crop (Table 2). Even though the impact of allelopathic effect of sunflower was higher in early days *viz.*, immediately after the harvest of sunflower compared to later days, the higher yield in D₁ (three weeks after harvesting of sunflower) compared to D₂, D₃ and D₄ was due to the non suitability of weather conditions prevailed during five and six weeks after harvesting of sunflower. It might be because of higher infestation of pests and disease in later stages of crop and deficit of soil moisture might have coincided with flowering stage resulted in lower seed yield of mungbean in delayed sowing dates (D₃ and D₄) treatments. The value of growth parameters like plant height and number of branches per plant were also significantly higher in early sown crop which were responsible for higher total dry matter per plant and increased value of yield components ultimately resulting in increased seed yield per ha. The plant height and number of branches per plant at harvest in early sown crop (June 28th) were 47.95 cm and 8.56, respectively (Table 1) which were significantly higher than crop sown at D₃ (12th July) and D₄ (19th July) after five and six weeks after harvest of sunflower and was on par with crop sown at D₂ (5th July), after four weeks after harvest of sunflower (47.30 cm and 8.20, respectively).

Interaction effect of cropping system and sowing dates on growth and yield of mungbean: In the present investigation, based on pooled data, the interaction effect of *kharif* mungbean preceded by summer fallow at the date of D₁ (CS₂D₁) was noticed significantly higher seed yield (971 kg ha⁻¹) as

compared to other interactions. However, the lowest seed yield was recorded in *kharif* mungbean sown after six weeks of harvest of summer sunflower (CS₁D₄-207 kg ha⁻¹) as compared to other treatment combinations. The increase in yield might be due to better manifestation of growth and yield attributing characters like plant height (57.16 cm), number of branches per plant (8.90) and number of pods per plant (13.84) which contributed to the higher seed yield (Table 2). The interaction effects of *kharif* mungbean sown after three weeks of harvest of summer sunflower recorded significantly higher seed yield (CS₁D₁-667 kg ha⁻¹) as compared to other treatment combinations of summer sunflower. This was mainly due to allelochemical produced by the sunflower plant residues were reduced by biodegradation (Waller and Dermer, 1980). As there was delay in the sowing period in the *kharif* mungbean preceded by summer sunflower (CS₁) the impact of allelopathy decreases exponentially and at later period of sowing, there was no significant difference in the yield of mungbean in treatment combinations such as *kharif* mungbean sown after five and six weeks of harvest of summer sunflower (CS₁D₃ and CS₁D₄, respectively). But in our study, mungbean crop sown after three weeks of harvest of sunflower (28th June) recorded significantly higher seed yield than other delayed sowing dates in both cropping system. The performance of crop in different cropping system was exceptionally well in terms of plant vegetative growth and pod setting when the crop was sown after three weeks of harvest of sunflower (D₁) as compared to other sowing dates. There was significant difference between the cropping systems in respect of grain yield in sowing dates of D₁ and D₂, where CS₁D₁ and CS₁D₂ recorded significantly lower yield (667 and 422kg/ha, respectively) than CS₁D₂ and CS₂D₂ (971 and 561kg/ha, respectively), where the allelopathic effect was nullified and both the systems were on par with each other in CS₁D₃ and CS₂D₃ and the similar effect in CS₁D₄ and CS₂D₄.

Conclusion: From the investigation, it can be concluded that there must be three to four weeks of interval between harvesting of summer sunflower and sowing of *kharif* mungbean. Sowing of mungbean must be before the end of June as it was indicated by higher yield in D₁ (28th June).

Table 1: Growth of mungbean as influenced by different cropping systems and sowing dates

Treatment	Plant height (cm)									No. of branches per plant								
	2014			2015			Pooled			2014			2015			Pooled		
	CS ₁	CS ₂	Me an	CS ₁	CS ₂	Me an	CS ₁	CS ₂	Me an	CS ₁	CS ₂	Me an	CS ₁	CS ₂	Me an	CS ₁	CS ₂	Me an
D ₁	56.48	62.99	59.74	21.00	51.33	36.17	38.74	57.16	47.95	8.54	9.03	8.79	7.90	8.77	8.34	8.22	8.90	8.56
D ₂	49.99	55.96	52.98	27.33	55.90	41.62	38.66	55.93	47.30	8.16	8.82	8.49	8.23	7.57	7.90	8.20	8.20	8.20
D ₃	44.20	46.57	45.39	39.33	42.87	41.10	41.77	44.72	43.24	8.00	8.27	8.14	7.53	7.77	7.65	7.77	8.02	7.89
D ₄	42.11	43.61	42.86	36.30	51.63	43.97	39.21	47.62	43.41	7.77	7.83	7.80	7.13	8.00	7.75	7.45	7.92	7.68
Mean	48.20	52.28		30.99	50.43		39.59	51.36		8.12	8.49		7.70	8.03		7.91	8.26	

	SE m.±	CD at 5%	SE m.±	CD at 5%	SE m.±	CD at 5%	SE m.±	CD at 5%	SE m.±	CD at 5%	SE m.±	CD at 5%
CS	0.13	0.8	0.78	2.34	0.455	1.57	0.02	0.11	0.09	0.27	0.05	0.19
D	1.49	4.4	1.1	3.3	1.295	3.85	0.04	0.13	0.21	0.63	0.13	0.38
CS xD	2.11	6.22	1.56	4.68	1.835	5.45	0.06	0.18	0.30	0.90	0.18	0.54

CS: Different cropping systems (CS)

D: Sowing dates (D)

DAS: Days after sowing NS: Non significant

CS₁: Kharif mungbean preceded by summer sunflower (June)

D₁: Three weeks after harvest of sunflower (28th)

CS₂: Kharif mungbean preceded by summer fallow

D₂: Four weeks after harvest of sunflower (5th July)

D₃: Five weeks after harvest of sunflower (12th July)

D₄: Six weeks after harvest of sunflower (19th July)

Table 2: Grain yield and No. of pods per plant of mungbean as influenced by different cropping systems and sowing dates

Treatment	No. of pods per plant									Grain yield (kg ha ⁻¹)								
	2014			2015			Pooled			2014			2015			Pooled		
	CS ₁	CS ₂	Mean	CS ₁	CS ₂	Mean	CS ₁	CS ₂	Mean	CS ₁	CS ₂	Mean	CS ₁	CS ₂	Mean	CS ₁	CS ₂	Mean
D ₁	11.03	13.84	12.44	10.43	12.23	11.33	10.73	13.04	11.88	660	893	777	673	1049	861	667	971	819
D ₂	10.11	11.78	10.95	10.43	11.90	11.17	10.27	11.84	11.06	564	631	598	279	491	385	422	561	491
D ₃	9.78	10.26	10.02	6.90	12.13	9.52	8.34	11.20	9.77	380	402	391	207	352	279.5	294	377	335
D ₄	9.72	10.15	9.94	5.23	12.43	8.83	7.48	11.29	9.38	302	428	365	111	200	155.5	207	314	260

CSxD	D	CS	SEM.±	CD at 5%	Mean
0.25	0.17	0.13			10.16
0.73	0.51	0.80			11.51
0.80	0.56	0.40			8.25
2.40	1.68	1.20			12.17
0.53	0.37	0.27			9.20
1.57	1.10	1.00			11.84
31	23	20			477
95	69	60			589
44	31	17			318
176	93	51			523
38	27	19			397
136	81	56			556

CS: Different cropping systems (CS)

DAS: Days after sowing NS: Non significant

CS₁: Kharif mungbean preceded by summer sunflower

D₂: Four weeks after harvest of sunflower (5th July)

D₄: Six weeks after harvest of sunflower (19th July)

D: Sowing dates (D)

D₁: Three weeks after harvest of sunflower (28th June)

CS₂: Kharif mungbean preceded by summer fallow

D₃: Five weeks after harvest of sunflower (12th July)

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