Journal of Tropical Agriculture 60(1): 108-112, 2022

Short Communication

Weed Management in Bush Type Cowpea (*Vigna unguiculata* subsp. *unguiculata* (L) *Verdcourt*)

J.K. Sinchana[1], Sheeja K. Raj[1]* and K. Prathapan[2]

[1]*College of Agriculture, Kerala Agricultural University, Thiruvananthapuram 695 522, Kerala, India*
[2]*Coconut Research Station, Balaramapuram, Thiruvananthapuram 695 501, Kerala, India*

Received 26 November 2021; received in revised form 10 May 2022; accepted 26 May 2022

Abstract
A field experiment was conducted at Coconut Research Station, Balaramapuram, Kerala during *Kharif* 2019 (June to September) to arrive at a cost-effective weed management practice for bush type cowpea. The experiment was conducted in RBD with seedbed preparation as first factor and weed management practices as second factor. Seedbed preparation comprised of stale seedbed and normal seed bed and weed management practices comprised of dried banana leaf mulch alone @ 10 t ha^{-1}, dried banana leaf mulch @ 10 t ha^{-1} followed by (*fb*) post emergence application of imazethapyr orquizalofop-p-ethyl @ 50 g ha^{-1}at 25 DAS, pre-emergence application of diclosulam @ 12.5 g ha^{-1} *fb* quizalofop-p-ethyl @ 50 g ha^{-1} or hand weeding at 25 DAS, hand weeding at 20 and 40 DAS and weed check. The results revealed that pod yield of bush type cowpea reduced by70 per cent due to weed infestation. Stale seedbed significantlyreduced the total weed density and dry weight and recorded higher pod yield compared to normal seedbed. Among the weed management practices, mulching with dried banana leaf @ 10 t ha^{-1} followed by quizalofop-p-ethyl application (50 g ha^{-1}) at 25 DAS recorded the lowest weed dry weight (3.77 g m^{-2}), the highest weed control efficiency (93%), pod yield (7589 kg ha^{-1}) and B:C ratio (1.71). Pre-emergence application of diclosulam *fb* application of quizal of op-p-ethyl at 25 DAS recoded higher WCE than hand weeding twice but recorded lesser yield. Among the treatment combinations, stale seedbed or normal seedbed + dried banana leaf mulching @ 10 t ha^{-1} *fb* quizalofop-p-ethyl@ 50 g ha^{-1} at 25 DAS recorded higher pod yield and B:C ratio (7731.7 kg ha^{-1} and 1.72 and 7446.3 kg ha^{-1} and 1.70, respectively) with a WCE of 95 and 91 per cent.

Keywords: Banana leaf mulch, Bush Cowpea, Diclosulam, Imazethapyr, Quizalofop-p-ethyl.

Cowpea is one of the most important leguminous vegetable crops.The pods are a good source ofdigestible protein, dietary fibre and Vitamin A and Vitamin C. Weeds causes severe yield loss in cowpea and also intensifies the disease and pest problems. Tripathi and Singh (2001) reported that weed infestation in cowpea caused a yield reduction of 82 per cent. If weeds are controlled up to 45 DAS, significant yield increase can be achieved in cowpea. Manual method is the most common method of weed control adopted by the farmers in vegetable production. Non-availability of labours and high wage rate necessitates an integrated approach involving both chemical and non-chemical methods. Integrated weed management (IWM) is a system approach to maintain the weed population below the economic threshold level by employing all available means of weed control in coordination. Hence, the present study was formulated with the objective to find out the cost-effective integrated weed management practice in vegetable cowpea.

Field experiment was conducted during *Kharif* 2019 (June to September 2019) at Coconut Research Station, Balaramapuram, Kerala located at 8° 22’ 52" North latitude and 77° 1’ 47" East longitude

*Author for Correspondences: Phone: 9495930693, Email: sheeja.raj@kau.in

and at an altitude of 9 m above mean sea level. It was laid out in Randomized Block Design with seedbed preparation (S) as first factor and weed management practices (W) as second factor in three replications. Seedbed preparation comprised of stale seedbed (S_1) and normal seedbed (S_2) and weed management practicescomprised of eight treatments *viz*., dried banana leaf mulch @ 10 t ha^{-1} (W_1), dried banana leaf mulch @ 10 t ha^{-1} *fb* imazethapyr 50 g ha^{-1} at 25 DAS (W_2), dried banana leaf mulch @ 10 t ha^{-1} *fb* quizalofop-p-ethyl 50 g ha^{-1} at 25 DAS (W_3), post emergence application of imazethapyr at 15 DAS (W_4), pre-emergence application of diclosulam 12.5 g ha^{-1} *fb* quizalofop-p ethyl @ 50 g ha^{-1} at 25 DAS (W_5), pre-emergence application of diclosulam 12.5 g ha^{-1} *fb* hand weeding at 25 DAS (W_6), hand weeding twice at 20 DAS and 40 DAS (W_7) and weedy check (W_8). The dried banana leaf along with the leaf petiole was used as the mulch. The soil of the experimental field was sandy loam in texture, medium in organic carbon, low in available N, high in available P and medium in available K. The variety used for the experiment was Bhagyalakshmy. Seeds were dibbled at a spacing of 30 cm x 15 cm. Seed rate adopted was 25 kg ha^{-1}. Lime was applied @ 250 kg ha^{-1}. Crop was fertilized with FYM @ 20 t ha^{-1}and N:P:K @ 20:30: 10 kg ha^{-1}. Half N, full P and K was applied as basal and remaining half N at 30 DAS. For stale seedbed, the land was prepared as similar in the case of normal seedbed, after the land preparation, a light irrigation was given and allowed the seeds to germinate for 10 days and then a light raking was given to uproot the weed seedlings. Seeds were sown on the next day. Dried banana leaves with the petioles were placed between the rows @ 10 t ha^{-1} after the germination of the crop (five days after sowing). Herbicides were applied as per the treatment using a flood jet nozzle. Total weed count was recorded by placing a quadrate of size 0.25 m x 0.25 m randomly at two spots in each treatment at 45 DAS. Weeds within the quadrate were uprooted, shade dried for a day and then dried to a constant weight in hot air oven at 60 ^{0}C. Pods per plant were recorded from 10 randomly selected plants and average was arrived at. Weed control efficiency (WCE) and weed index (WI) were worked out using standard procedures.

Table 1. Effect of seedbed preparation and weed management practices on weed density, weed dry weight, WCE, pods per plant, pod yield, WI and B:C ratio in bush cowpea

Treatments	Total density (no. m^{-2}) (45 DAS)	Total weed dry weight (g m^{-2}) (45 DAS)	WCE (%)	Pods per plant	Pod yield (kg ha^{-1})	WI	B:C ratio
Seed bed preparation (S)							
S_1	5.92 (34.05)	3.27 (9.71)	82	36.9	6286.2	18.61	1.43
S_2	6.81 (45.42)	4.31 (17.58)	68	32.6	5638.1	26.65	1.32
CD (0.05)	0.29	0.11		1.2	176.93		
Weed management practices (W)							
W_1	4.12 (16.0)	2.98 (7.87)	86	39.2	7009.3	9.14	1.64
W_2	4.28 (17.3)	2.59 (5.70)	89	42.3	7337.3	5.06	1.67
W_3	4.51 (19.3)	2.18 (3.77)	93	44.0	7589.0	1.81	1.71
W_4	7.58 (56.7)	5.39 (28.09)	48	30.0	5103.2	33.92	1.22
W_5	5.59 (30.2)	2.29 (4.28)	92	33.5	5883.3	23.81	1.36
W_6	6.32 (39.0)	2.61 (5.80)	89	32.0	5631.8	25.62	1.29
W_7	5.97 (34.7)	2.48 (5.13)	90	36.7	6024.3	21.97	1.29
W_8	10.2 (104.7)	7.04 (48.53)	10	21.2	3113.7	59.70	0.77
CD (0.05)	0.58	0.22	-	2.6	353.47		

Values in parentheses are original values, data are subjected to square root transformation $\sqrt{(x+1)}$

S_1:stale seedbed, S_2: normal seedbed, W_1: dried banana leaf mulch @ 10 t ha^{-1}, W_2: dried banana leaf mulch @ 10 t ha^{-1} *fb* imazethapyr @ 50 g ha^{-1} at 25 DAS, W_3: dried banana leaf mulch @ 10 t ha^{-1}*fb* quizalofop-p-ethyl @ 50 g ha^{-1}at 25 DAS, W_4: post emergence application of imazethapyr @ 50 g ha^{-1}, W_5: pre-emergence application of diclosulam@ 12.5 g ha^{-1}*fb* quizalofop-p-ethyl @ 50 g ha^{-1} at 25 DAS, W_6: pre-emergence application of diclosulam @ 12.5 g ha^{-1}*fb* hand weeding at 25 DAS, W_7: hand weeding at 20 and 45 DAS and W_8: weedy check

For calculating the WCE, the treatment S_2W_8 was taken as the weedy check and for calculating the WI, the treatment S_1W_3 which recorded the highest yield was taken as the weed free treatment. Data on weed density and dry weight were transformed using square root transformation "x +1". Pods were harvested from the net plot area of each treatment from 45 DAS, yield was recorded and expressed in kg ha^{-1}. Economics was worked out based on the prevailing market price of the inputs and price of the pods (Rs 20 kg $^{-1}$). All data were statistically analysed except, B: C ratio, WCE and WI. The treatment means were compared at 5 per cent probability level.

The grassy weeds, *Setaria barbata* and *Digitaria sanguinalis*, broad leaf weeds, *Alternanthera sessilis*, *Phyllanthus amarus* and *Synedrella nodiflora* and the sedge, *Cyperus rotundus* were the major weed flora in the experimental field.

Stale seedbed reduced the total weed density by 25 per cent and weed dry weight by 45 per cent compared to normal seedbed. Significantly lower weed density, weed dry weight and higher WCE observed in stale seedbed might be due to the removal of germinated weeds prior to planting, resulted in the depletion of weed seed bank in the surface soil and subsequent emergence of weeds. Arora and Tomar (2012) and Tehria et al. (2015) reported that, due to significant reduction in weed density, stale seedbed recorded the lowest weed dry weight and higher WCE in groundnut and pea.

Among the weed management treatments. W_1 (dried banana leaf mulch @ 10 t ha^{-1} alone) recorded lower weed density and it was statistically on par with W_3 and W_2 (dried banana leaf mulch @ 10 t ha^{-1} *fb* quizalofop-p-ethyl and imazethapyr @ 50 g ha^{-1} at 25 DAS). However, W_3 (dried banana leaf mulch @ 10 t ha^{-1} *fb* quizalofop-p-ethyl @ 50 g ha^{-1} at 25 DAS) recorded lower weed dry weight and was statistically on par with W_5 (pre-emergence application of diclosulam @ 12.5 g ha^{-1} *fb* quizalofop- p-ethyl @ 50 g ha^{-1} at 25 DAS). Weed control efficiency also followed the same trend as that of total weed dry weight. The reduction in total weed density and weed dry weight observed in treatments W_1 ,W_2 and W_3 were owing to the fact that banana leaf as mulch on the soil surface obstructed the germination and growth of weeds in the early stages of crop growth. The result is in consonance with the observations made by Kosterna (2014). The reduction in total weed density and weed dry weight observed in W_5 and $W_6$was due to the better control of weeds resulting from the pre-emergence application of diclosulam followed by the post emergence application of quizalofop-p-ethyl/hand weeding at 25 DAS.

Among the treatment combinations, stale seedbed + dried banana leaf mulch @10 t ha^{-1} *fb* imazethapyr @ 50 g ha^{-1} at 25 DAS (S_1W_2) recorded the lowest weed density which was statistically on par with S_1W_1 (stale seedbed + dried banana leaf mulch @ 10 t ha^{-1}). However, S_1W_6 (stale seedbed + pre-emergence application of diclosulam 12.5 g ha^{-1} *fb* hand weeding at 25 DAS) recorded the lowest total weed dry weight which was statistically on par with S_1W_5 (stale seedbed + pre-emergence application of diclosulam @ 12.5 g ha^{-1} *fb* quizalofop-p-ethyl @ 50 g ha^{-1} at 25 DAS) and S_1W_3 (stale seedbed + dried banana leaf mulch @ 10 t ha^{-1} *fb* quizalofop-p-ethyl @ 50 g ha^{-1} at 25 DAS). Weed control efficiency followed the same trend as that of weed dry weight. Lower weed density, weed dry weight and higher WCE recorded in S_1W_6, S_1W_5 and S_1W_3 might be due to better control of weeds right from the early growth stage of the crop. Nainwal et al. (2010), reported that pre-emergence application of diclosulam alone or pre-emergence application of diclosulam *fb* hand weeding at 20 DAS or haloxyfop-p-methyl at 21 DAS recorded lower weed biomass in soybean. Akobondu (1987) and Shenk (1994) observed that mulching with organic residues suppress the germination of weeds and significantly reduced the weed density and weed biomass.

Stale seedbed recorded 12 per cent higher grain yield and lower weed index than the normal seedbed. B: C ratio was also higher in stale seedbed (1.43). Control of first flush of weeds prior to sowing of cowpea in stale seedbed reduced the crop weed competition which create a favourable environment for the crop to grow resulting in the production of higher number of pods per plant (Table 2) which finally led to higher pod yield with lower WI and higher B:C ratio. The result is in agreement with the findings of Kumar et al. (2018) who reported that stale seedbed recorded significantly higher jute yield compared to normal seed bed due to better control of first flush of weeds.

Weed management practices resulted in a yield increase of 39 to 59 per cent. Among the weed management practices, mulching with dried banana leaf @10 t ha^{-1} *fb* quizalofop-p- ethyl @50 g ha^{-1} at 25 DAS (W_3) recorded higher pod yield and was statically on par with dried banana leaf mulch 10 t ha^{-1}*fb* imazethapyr @ 50 g ha^{-1} at 25 DAS (W_2). The treatment W_3 recorded the lowest weed index which was significantly superior over other treatments and it was followed by treatment W_2. Higher pod yield and lower WI registered in these treatments might be due to the least crop weed competition and also due to the favourable influence of mulching in avoiding the fluctuations in soil temperature, reducing the evaporation loss of soil moisture and addition of organic matter to the soil by decomposition and thus providing an optimum condition for the utilization of available nutrients for growth and yield.

The interaction effect was also found significant and the treatment combination, S_1W_3 (stale seedbed + dried banana leaf mulch @ 10 t ha^{-1} *fb* quizalofop-p-ethyl @ 50 g ha^{-1}at 25 DAS) recorded the highest pod yield which was statistically on par with S_1W_2 (stale seedbed + dried banana leaf mulch @ 10 t ha^{-1} *fb* imazethapyr @ 50 g ha^{-1} at 25 DAS) and S_2W_3 (normal seedbed + dried banana leaf mulch @ 10 t ha^{-1} *fb* quizalofop-p-ethyl at 25 DAS) (Table 2). Though the treatments, S_1W_5 and S_1W_6 recorded lower weed dry weight and higher WCE than other treatments, the pod yield recorded was lower due to the production of lesser number of pods per plant (Table 2). The result revealed that mulching with dried banana leaf not only control the weeds but also create a favourable environment for the best utilization of resources which resulted in the production of higher number of pods per plant

Table 2. Interaction effect between seedbed preparation and weed managementpractices on weed density, weed dry weight,WCE, pods per plant, pod yield, WI and B:C in bush cowpea

Treatments	Total density (no. m^{-2}) (45 DAS)	Total weed dry weight (g m^{-2}) (45 DAS)	WCE (%)	Pods per plant	Pod yield (kg ha^{-1})	WI	B: C ratio
S_1W_1	3.61 (12.0)	2.16 (3.70)	93	40.7	7226.3	6.31	1.67
S_1W_2	3.42 (10.7)	2.07 (3.30)	94	43.0	7483.3	3.24	1.68
S_1W_3	4.28 (17.3)	1.87 (2.50)	95	44.7	7731.7	0.00	1.72
S_1W_4	7.46 (54.7)	4.29 (17.43)	68	31.3	5490.7	28.96	1.30
S_1W_5	5.55 (29.8)	1.67 (1.77)	97	37.7	6047.0	21.75	1.38
S_1W_6	4.99 (24.0)	1.62 (1.32)	98	32.0	5986.0	22.30	1.36
S_1W_7	6.39 (40.0)	2.42 (4.89)	91	39.3	6429.0	16.74	1.36
S_1W_8	9.22 (84.0)	6.60 (42.70)	22	26.7	3895.3	19.52	0.95
S_2W_1	4.58 (20.0)	3.61(12.01)	78	37.7	6792.3	11.93	1.61
S_2W_2	4.99 (24.0)	3.02 (8.09)	85	41.7	7191.3	6.88	1.66
S_2W_3	4.72 (21.3)	2.45 (5.03)	91	42.0	7446.3	3.60	1.70
S_2W_4	7.71 (58.7)	6.30 (38.75)	29	28.7	4715.7	38.89	1.14
S_2W_5	5.63 (30.7)	2.79 (6.79)	87	29.3	5729.7	25.87	1.34
S_2W_6	7.42 (54.0)	3.36 (10.28)	81	32.0	5277.7	28.96	1.23
S_2W_7	5.49 (29.3)	2.52 (5.37)	90	34.0	5619.7	27.20	1.22
S_2W_8	11.24 (125.3)	7.44 (54.35)	0	15.7	2332.0	69.87	0.58
CD (0.05)	0.82	0.34	-	3.5	499.9		

Values in parentheses are original values, data are subjected to square root transformation $\sqrt{(x+1)}$

(Table 2) and contributed to higher pod yield.The treatment combination, S_1W_3 recorded higher B:C ratio (1.72) which was followed by S_2W_3 (1.70). The higher B:C ratio registered in these treatments was due to higher gross return obtained as a result of higher pod yield (Table 2).

In bush type vegetable cowpea weed competition resulted in a yield reduction of 70 per cent. Stale seedbed recorded significantly lower weed density and dry weight compared to normal seedbed and recorded higher pod yield. Among the weed management treatments, mulching with dried banana leaf @ 10 t ha^{-1} *fb* quizalofop-p-ethyl 50 g ha^{-1} at 25 DAS recorded higher WCE, pod yield and B:C ratio. Considering the weed control efficiency, pod yield and economics, either stale seedbed or normal seedbed, + mulching with dried banana leaf @ 10 t ha^{-1} *fb* quizalofop-p-ethyl can be recommended as an integrated cost-effective weed management practice for weed control in bush type cowpea.

References

Arora, A. and Tomar, S.S. 2012. Effect of soil solarization on weed seed bank in soil. Indian J. Weed Sci., 44 (2): 122-123.

Akobundu, I.O. 1987. Weed science in the tropics principles and practices. John Wiley and Sons, Chichester, 522p.

Kosterna, E. 2014. The effect of different types of straw mulches on weed control in vegetable cultivation. J. Ecol. Eng., 15 (4): 109-117.

Kumar, M., Ghorai, A.K., Nandy, U., Mitra, S., and Kundu, D.K. 2018. Effect of stale seedbed and subsequent application of herbicides on weeds and productivity of jute (*Corchoruss olitorius* L.) fibre. J. Agri. Search, 5 (1): 8-12.

Nainwal, R.C., Saxena, S.C., and Singh, V.P. 2010. Effect of pre and post emergence herbicides on weed infestation and productivity of soybean. Indian J. Weed Sci., (1&2): 17-20.

Shenk, M.D. 1994. Cultural practices for weed management, In Weed Management for Developing Countries. In: Labrada, R., Caseley, J.C., and Parker, C (eds), FAO Plant Protection and Protection Paper 120, pp.163-170.

Tehria, S.K., Rana, S.S., and Kumar, S. 2015. Nutrient uptake by weeds and pea as influenced by phosphorus and weed management. Indian J. Weed Sci., 47 (2): 144-149.

Tripathi, S.S. and Singh. 2001. Critical period of weed competition in summer cowpea (*Vigna unguiculata* L.). Indian J. Weed Sci., 33: 67–68.