

Common Vetch

a new threat to rice-fallow pulses in coastal Andhra Pradesh

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Cultivation of blackgram and greengram in rice-fallows in coastal districts of Andhra Pradesh is a common practice. In this type of cultivation, the sprouted seeds of pulses are directly broadcast in standing rice crop two-to-three days prior to harvest as a relay crop. Thus, the pulses sown in this system survive entirely on residual soil moisture and fertility. This type of cultivation is also known as paira or utera cultivation.

Key words: Coastal area, Pulses, Rice, Vetch

FARMERS of this tract consider rice-fallow pulses as a bonus crop on account of low input requirement, short duration, ability to establish with surface broadcast in standing rice fields and soil fertility restoration property. Indeed, the non-remunerative proposition of rice cultivation in the recent past due to spiralling cost of farm inputs and labour owing to insufficient availability coupled with inadequate price support for rice grain may well be compensated to a reasonable extent by the relay crop of pulse and thus infusing certain amount of stability to family economy of peasants, especially of the tenant farmers. However, over the past decade productivity of this opportunity crop has been gradually dwindling owing to various constraints such as sparse crop stand, delayed planting, severe weed infestation, lack of prospect for fertilizers application either as basal or top dressing, proneness to diseases like yellow mosaic virus, *Cercospora* leaf spot, powdery mildew and pests like aphids and pod borers, and terminal drought.

Research efforts over years resulted in generating an array of solutions to address some of the persistent constraints like sparse crop

stand, delayed planting, lack of prospect for fertilizers application etc.

Sparse crop stand: Puddling rice paddies with cattle atleast thrice followed by levelling the entire field to a very fine plane before transplanting rice seedling was the usual practice of yester-years. However, with the availability of hired tractors in every nook and corner and with the gradual disappearance of draught animals due to increasing cost of their maintenance, field preparation for rice is reduced to mere churning of soil in a film of water without paying required attention to levelling, a pre-requisite for establishment of proper establishment of relay pulse crop. As a measure to achieve optimum crop stand, doubling the seed rate in greengram from 15 to 30 kg/ha and in case of blackgram from 20 to 40 kg/ha was suggested.

Delayed planting: Due to frequent delay in the onset of monsoon that lead to late release of canal water and progressively escalating costs for puddling, nursery raising, pulling, transportation of nursery bundles and transplanting of seedlings in the main field involved in conventional system of rice crop establishment, rice growers of this region gradually switching over from traditional

system of transplanting to semi-dry system to curtail cultivation expenses. This is made possible further with the availability of an array of highly selective herbicides to control a broad spectrum of weeds, a familiar problem in semi-dry rice. Besides, resorting to medium duration rice cultivars as against the earlier practice of long duration genotypes also allowed rice crop to come to maturity early by about 10 days and thus enabled advancement of sowing window of rice fallow pulses.

Lack of prospect for fertilizers application: Although the possibility of application of fertilizers is ruled out in view of its growing conditions under receding soil moisture, the consistent efforts of scientists resulted in development of foliar nutrition package to tackle the nutrient needs of rice-fallow pulses like foliar feeding of 19-19-19 or KNO₃ @ 0.1% twice at early budding and pod filling stage.

Proneness to diseases and pests: While varieties like LGG-407, LGG-460, WGG-37 in greengram and LBG-752 and PU-31 in blackgram were identified as tolerant to Yellow Mosaic Virus, *Cercospora* leaf spot and powdery mildew could be tackled to a great extent by spraying carbendazim @ 0.1% and Mancozeb

@ 0.25% one after the other from 7 to 10 days interval on need-based approach. Aphids, which are of common occurrence among the sucking complex in pulses and cause great yield loss in a very short span of time could be controlled by spraying neem-seed kernel extract (NSKE) @ 5%, and if necessary apply acepahte 1.25 g/l of water at 10 to 15 days interval. The incidence of Maruca pod borer that usually occurs after appearance of floral buds could be managed by spraying either novaluron @ 1.0 ml or spinosad @ 0.245 g/l of water.

Terminal drought: With the advancement of sowing window by resorting to medium duration rice cultivars and change over from the traditional transplanting of rice to direct sown semi-dry system by the farming community of this tract, the sowing window of rice-fallow pulses could be advanced by 15-20 days so as to enable the short duration pulse crops to maturity before the temperatures shoot up to cause terminal stress.

Severe weed infestation: Weed menace needs special attention as it reduces the yield to an extent of 53 %. Due to sparse crop stand and unfriendly environment in which pulse crops have to complete their life-cycle, severe weed infestation is identified as one of the major setbacks for realization of potential yields. The normal methods of weed management like hand weeding is not practised by farmers in rice-fallow pulses system because of the problem of trampling of crop, which leads to loss of crop stand and also difficult to practice due to presence of dense stubbles of rice crop besides receding soil moisture conditions. Although pre-emergence herbicides like pendimethalin @ 2.5 l/ha recommended, its application under relay system of pulse crop establishment gives hardly



Fig. 1. Common vetch infested rice-fallow greengram in farmers' filed

any scope for herbicide application due to non-removal of rice sheaves from the field after harvesting for 5-6 days till they dry and thus could not gain popularity among the pulse growers in view of practical difficulties.

Post-emergence application of imazethapyr @ 500 ml ha⁻¹ although found to control most of the grassy and broadleaf weeds, it failed to cause any tangible damage to the most dreaded weed called common vetch (*Vicia sativa* L.) that continues to threaten the rice-fallow pulse cultivation in this part of Andhra Pradesh.

The menace of common vetch (*Vicia sativa* L.): Vernacularly called *Rangam minumu*, is one of the most prevalent weeds in rice-fallow pulses, spreading vigorously in recent years in coastal Andhra Pradesh. This weed not only compete for moisture, nutrients and light with pulse crop but also adds its seed with pulse grain, being similar in size and shape, fetching lower market price in addition to spreading to newer areas when used as seed.



Fig. 2. Weddy check

Morphology: Common vetch is an annual leguminous vine climbing by means of branched tendrils. The leaves are divided like a feather into 3 to 10 pairs of small narrow leaflets, each 8 to 30 mm long. It has almost stalkless pink to purple flowers, each 1 to 2 cm long and either single or in few flowered clusters. The pod is narrow, slightly flattened and 3 to 5 cm long, brown to yellow, hooked at tip, 6 to 12 seeds on short stalk and usually constricted around each seed. Seeds are globular to flattened or oblong, smooth, 3.5 to 6.5 mm long.

Biology and ecology: Seeds of common vetch that shed in the previous year remain dormant throughout rice growing season in *kharif* and germinate in winter along with rice-fallow pulses when sown next and grows over the cooler months. It flowers during mid-January along with rice-fallow pulse crops and dies in late February or early March coinciding with maturity of crop. Common vetch has the ability to adjust its life-cycle in tune with the duration of relay pulse and thus exhibits phenotypic mimicry. It produces some hard dormant seed which are tolerant to waterlogging. Pods shatter readily preventing efficient harvesting and leaving seed to contaminate following crops. It grows on all types of agricultural soils. To cause grain contamination, one plant m⁻² is sufficient. It spreads

mainly by man, as a contaminant of pulse seed and along with crop residue when applied as manure to newer sites. When animals feed on the dry haulm or crop residue, the undigested seed pass through digestive track of cattle and mix with farmyard manure and thus spread to new crop fields. Recent observations revealed that the routine practice of allowing herds of sheep to move across the pulse growing areas soon after harvesting the crop is mainly responsible for spreading

dormant seed to newer areas as they feed on the mature parts of common vetch, a delicious legume roughage for sheep and spreads the seed through faecal matter to even distant places. It spreads rapidly that common vetch engulfed majority of rice-fallow pulse growing areas of the zone in a short duration.

Intricacies involved in common vetch management: In peculiar conditions under which rice-fallow pulses are cultivated and due to its problematic nature and difficulties involved in controlling common vetch effectively by mechanical/cultural means, research was done to identify a suitable selective herbicide to control common vetch. Although herbicides were found effectively to control a broad spectrum of weeds in pulses like fluchloralin, pendimethalin, imazethapyr etc., none of them were found effective against common vetch. The core of the issue involved in management of common vetch in rice-fallow pulses is that both the weed and the pulse crop belong to same family Leguminosae and thus field trials to screen a selective herbicide to address the menace of common vetch remained a tough task for fairly a long period.

Field trials

In a pursuit to identify an appropriate selective herbicide to control common vetch in rice fallow pulses, an observation trial was conducted during *rabi* 2014-15 simultaneously in Agricultural College Farm, of Acharya N G Ranga Agricultural University, Naira (Srikakulam District) and in nine other locations in the farmers' fields, where the menace of common vetch was rampant. Rice-fallow greengram was sown as per the farmers' practice during the last week of November in all the locations (Fig. 1). A new herbicide molecule sodium acifluorfen + clodinafop-propargyl was applied as early post-emergence spray at 25 days after sowing at two different concentrations i.e. 0.196 kg a.i ha⁻¹ (1.8 ml/l) and 0.245 kg a.i ha⁻¹ (2.0 ml/l) and were compared with the commonly recommended pendimethalin @ 0.75 kg a.i ha⁻¹

Table 1. Weed parameters of common vetch and yield attributes of rice-fallow greengram as influenced by herbicide treatments.

Treatments	Weed parameters			Yield attributes (Greengram)					
	Weed density at 30 DAS (No. m ⁻²)	Weed dry weight at 30 DAS (kg ha ⁻¹)	Crop dry matter at 30 DAS (kg ha ⁻¹)	No. of branches plant ⁻¹	No. of pods plant ⁻¹	Pod length (cm)	Pod weight (g)	No. of seeds pod ⁻¹	Test weight (g)
T ₁ : Weedy check	366.0	274.8	404.0	4.6	10.2	6.9	0.44	8.1	25.1
T ₂ : Weed free check	1.5	0.96	669.9	5.8	17.4	7.8	0.55	10.8	30.1
T ₃ : Pendimethalin @ 5.0 ml/litre (0.75 kg a.i/ha)	320.0	234.2	464.0	4.8	12.6	6.7	0.46	8.6	28.6
T ₄ : Pendimethalin @ 6.6 ml/litre (1.0 kg a.i/ha)	238.0	152.3	488.0	5.4	13.2	6.9	0.41	8.7	29.0
T ₅ : Sodium acifluorfen+clodinafop-propargyl @ 1.8 ml/litre (19.6 g a.i/ha)	64.0	41.0	584.0	5.0	16.0	7.1	0.49	9.4	29.6
T ₆ : Sodium acifluorfen + clodinafop-propargyl @ 2.0 ml/litre (24.5 g a.i/ha)	52.0	33.3	648.0	5.8	16.2	7.3	0.53	10.4	30.0

DAS, Days after sowing

(5.0 ml/l) and 1.0 kg a.i ha⁻¹ (6.6 ml/l) as pre-emergence spray besides weedy check and weed free check. A spray volume of 500 l ha⁻¹ of water was used for uniform application of herbicides. There were no phytotoxic symptoms on greengram due to foliar application of sodium acifluorfen + clodinafop-propargyl or pendi-

methalin. The mean data recorded across all the 10 locations on weed parameters of common vetch and yield attributes of greengram are presented in Table 1 and seed yield, haulm yield, weed control efficiency, weed index and economics of common vetch management are presented in Table 2.

Table 2. Seed yield, Weed control efficiency (WCE), Weed index (WI) and economics of rice-fallow greengram as influenced by herbicide treatments.

Treatments	Seed yield (kg ha ⁻¹)	Haulm yield (kg ha ⁻¹)	WCE (%)	WI (%)	Economics		
					Additional cost (₹ ha ⁻¹)	Additional returns (₹ ha ⁻¹)	Returns per rupee invested (₹)
T ₁ : Weedy check	475	871	—	44.2	-	-	-
T ₂ : Weed free check	752	1,455	99.6	—	6,750	18,005	2.7
T ₃ : Pendimethalin @ 5.0 ml/litre (0.75 kg a.i/ha)	482	926	44.6	43.4	875	455	0.5
T ₄ : Pendimethalin @ 6.6 ml/litre (1.0 kg a.i/ha)	500	1,070	14.8	41.3	1,155	1,625	1.4
T ₅ : Sodium acifluorfen + clodinafop-propargyl @ 1.8 ml/litre (19.6 g a.i/ha)	657	1,256	85.0	29.9	1,440	11,830	8.2
T ₆ : Sodium acifluorfen+ clodinafop-propargyl @ 2.0 ml/litre (24.5 g a.i/ha)	708	1,446	87.8	5.1	1,800	15,145	8.4



Fig. 3. T₆: Sodium acifluorfen + clodinafop-propargyl @ 2.0 ml / litre

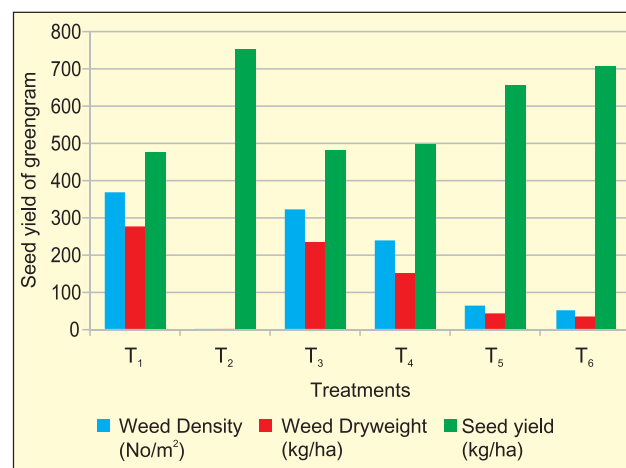


Fig. 4. Seed yield of greengram as influenced by the density and drymatter of common vetch.

Data revealed that early post-emergence application of sodium acifluorfen + clodinafop-propargyl at both the doses (1.8 and 2.0 ml/l) was found to exert profound influence in suppressing the density and dry weight of common vetch compared to pendimethalin (Table 1). There was a massive 81.9% reduction in the density and 87.9% dry weight of common vetch due to early-post emergence application of acifluorfen + clodinafop-propargyl @ 2.0 ml/l (0.245 kg a.i ha⁻¹) when compared with weedy check (Fig. 2). All the yield attributes of greengram *viz.*, number of branches plant⁻¹, number of pods plant⁻¹, pod length, pod weight, number of seeds pod⁻¹ and test weight were found to be the highest in weed free check while, among the herbicides, early post-emergence application of sodium acifluorfen + clodinafop-propargyl @ 2.0 ml l⁻¹ recorded the highest yield structure, indicating its supremacy over the lower dose of the same herbicide as well as pendimethalin

(Table. 1). Weed control efficiency (WCE) and Weed index (WI) worked out for various weed control treatments indicated that early post-emergence application of sodium acifluorfen + clodinafop-propargyl @ 2.0 ml l⁻¹ (T₆) has a profound impact on *Vicia sativa* as reflected from the lowest weed density and weed drymatter recorded with this treatment (Fig. 3).

Maximum seed yield of 752 kg/ha was obtained under weed free environment (T₂) while, among the herbicide applied treatments, application of sodium acifluorfen + clodinafop-propargyl @ 2.0 ml l⁻¹ (T₆) recorded the highest seed yield (708 kg/ha) which was just 44.0 kg less than the best weed management option in any crop (weed free check) and thus emerged as the best herbicide to check the menace of common vetch (Fig. 4).

As regards the economics of various weed control treatments, although highest additional returns were realized with weed free check

(T₂), maximum returns per rupee invested (8.4) were observed with the application of sodium acifluorfen + clodinafop-propargyl @ 0.245 kg ai ha⁻¹ (T₆) or 1.0 litre ha⁻¹ on formulation basis and proved to be both agronomically and economically the best weed management option to check the menace of common vetch.

SUMMARY

Even though, the findings of the current study were emanated from an observational trial conducted in the most seriously *Vicia sativa* infested locations in the farmers' fields, the results obtained from the study were found to be of great significance and paves way for a systematic investigation to generate valuable information through structured field experimentation.

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