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Evaluation of an effective cultural management practices for the management of gall weevil *Alcidodes collaris* (Pascoe) in pigeonpea

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Abstract
Pigeonpea is an important pulse crop is known to attack by wide range of insect pests from seedling stage to storage. Among these, recently gall weevil causing threat to pigeonpea at seedling stage. Investigation on management of gall weevil using cultural practices revealed that less incidence of gall weevil was recorded in redgram intercropped with cowpea with only 1.17 galled plants per 10 plants and also highest percent reduction of galled plants over control (82.45 %). Followed by redgram + soybean with 2.33 galled plants per 10 plants and 65.07 percent reduction of galled plants over control. Redgram equivalent yield of intercrop added to redgram yield was significantly higher in redgram+ cowpea (28.87 q/ha) intercropping system.

Keywords: *Alcidodes collaris*, gall weevil, incidence, cowpea, soybean, management

1. Introduction
Pigeonpea (*Cajanus cajan* (L.) Millsp.) is an important pulse crop, legume, perennial shrub grown in tropics and subtropics. Pigeonpea has deep root system, due to this it offers little competition to associated crops and is therefore used in intercropping systems. As a legume, it fixes about 40 kg/ha atmospheric nitrogen and adds valuable organic matter to soil (Adu Gyamfi *et al*., 2007) [1]. The pigeonpea is known to attack by a wide range of insect pests both in the field (at various stages of crop growth) and storage. Insects consume and damages almost all parts of the pigeonpea plant (Upadhyay *et al*., 1998) [6].
In recent years gall weevil, *Alcidodes collaris* (Pascoe) is becoming an important pest especially in the northern transitional belt of Karnataka. The pest damages at seedling stage and also vegetative stage of the crop and causes upto 25-30 per cent reduction in plant population. It attacks the basal region of seedlings and resulting in the gall formation at the collar region leads to dislodging and drying of plants (Parchabhavi *et al*., 1972; Rachappa and Lingappa, 2006) [5].
Pigeonpea gall weevil *A. collaris* belongs to the subfamily Alcidinae of family Curculionidae and order Coleopteran. Medium sized body with brown pronotum, creamish spots on the black elytra, geniculate antenna and 4 segmented tarsi are the taxonomic characteristics of pigeonpea gall weevil. The gall weevil damages by scraping at the basal portion of the stem for egg laying. After hatching, grubs feeds on internal tissues of the stem leads to gall formation at the collar region finally dislodging and drying of the plant occurs (Hugar, 2001) [2]. Since the pest inhabits in the soil near the basal portion of stem, makes difficult for its prediction of infestation, distribution and damage. Few studies were carried out in controlling the pest, but still there is a lacuna in controlling the pest. Keeping these points an experiment was conducted to evaluate an effective cultural management practices for the management of gall weevil.

2. Materials and methods
An experiment was conducted at Main Agricultural Research Station, Dharwad with the different cultural management practices for the management of pigeonpea gall weevil. The field experiment laid out using randomized block design consists of 9 treatments with 3 replications, along with untreated check. The variety used for the experiment was TS-3R with the spacing 120 cm × 20 cm in the plot having the size of 5 m × 3 m. Sowing was done during 1st week of July along with different intercrop treatments. The recommended package of practices carried out except plant protection measures at vegetative stage of the crop.

Only in the later stage chemical spray has been taken for the management of pod borer.

The observations were made to evaluate the effectiveness of the different treatments which included the intercrops. The total number of plants and the gall formed plants was recorded at 25 and 50 days after crop emergence in each plot. The plant stand at harvest was recorded and per cent reduction in plant stand has been worked out. The observations were also recorded on yield in both redgram and other intercrops. Then, redgram equivalent yield of the system (REY) was calculated using the formula,

$$REY = \frac{\text{Seed yield of intercrops} \times \text{price}}{\text{Pigeonpea seed price}} + \text{Pigeonpea seedyield}$$

Finally, the yield and cost economics data were subjected to statistical analysis.

3. Results

3.1 Influence of intercropping on occurrence of gall weevil

The intercrop influenced very much on the incidence of gall weevil. Among the treatments statistically the significant lowest incidence was observed in case of redgram + cowpea intercrop, with only 1.17 galled plants per every 10 plants. This was followed by redgram + soybean with only 2.33 galled plants per 10 plants. In other intercrops the incidence was less compared to the control. The same treatment when analyzed for the per cent reduction of galled plants over untreated check (control) it clearly indicated very high variation in redgram + cowpea intercrop with 82.45 per cent reduction in galled plants. The next best was redgram + soybean with 65.07 per cent reduction in galled plants followed by redgram + sesamum with 50.07 per cent reduction in galled plants. These was followed by other treatments mainly redgram + niger with 47.53 per cent reduction in galled plants, redgram + sorghum with 44.98 per cent reduction and redgram+ navane with 42.58 per cent reduction in galled plants. The least influence was observed in redgram+ greengram and transplanted redgram with 35.08 per cent reduction in the galled plants over control (Table 1).

Table 1: Influence of intercropping on occurrence gall weevil in pigeonpea

Sl. No.	Treatment	Row ratio	No. of galled plants/10 plants			Per cent reduction of galled plants over control
			25 DAS	50 DAS	Mean	
T_1	Redgram + Cowpea	1:3	1.33 (1.34)^{a}	1.00 (1.22)^{a}	1.17 (1.29)^{a}	82.45
T_2	Redgram + Soybean	1:3	2.33 (1.68)^{ab}	2.33 (1.66)^{b}	2.33 (1.68)^{b}	65.07
T_3	Redgram + Greengram	1:3	4.33 (1.86)^{bc}	4.33 (2.18)^{c}	4.33 (2.20)^{c}	35.08
T_4	Redgram + Niger	1:3	4.00 (2.11)^{bc}	3.00 (1.86)^{bc}	3.50 (2.00)^{bc}	47.53
T_5	Redgram + Sesamum	1:3	3.33 (1.95)^{bc}	3.33 (1.95)^{bc}	3.33 (1.96)^{bc}	50.07
T_6	Redgram + Navane	1:3	3.33 (1.94)^{bc}	4.33 (2.19)^{c}	3.83 (2.08)^{bc}	42.58
T_7	Redgram + Sorghum	1:3	3.00 (2.18)^{c}	4.33 (2.20)^{c}	3.67 (2.04)^{bc}	44.98
T_8	Transplantation of redgram	_	4.00 (2.11)^{bc}	4.67 (2.27)^{bc}	4.33 (2.20)^{c}	35.08
T_9	Untreated check	_	6.33 (2.61)^{d}	7.00 (2.73)^{d}	6.67 (2.68)^{d}	_
	SEm±		0.14	0.14		
	CD (P=0.05)		0.43	0.43		
	CV (%)		12.46	12.19		

*Mean of three replications.

In a column means followed by same alphabet are not significantly different at P = 0.05% as per DMRT.

Values in parentheses are square root transformation.

DAS- Days after sowing

3.2 Yields in different intercrops in managing the gall weevil

The yields are varied among the different intercrops. The highest yield was recorded in transplanted redgram with 23 q/ha followed by redgram+ cowpea with 20.78 q/ha of redgram and 10.78 q/ha of cowpea. Followed by redgram + soybean with 18.44 q/ha redgram and 10.67 q/ha of soybean. Remaining treatments with 17.56 q/ha, 16.22 q/ha, 16.11q/ha, 14.22 q/ha, 10.56 q/ha redgram in redgram + navane, redgram + sesamum, redgram + greengram, redgram + sorghum, redgram + Niger respectively. The least was recorded in case of untreated check with only 11.22 q/ha redgram only. When the redgram equivalent yield of intercrops is considered, the maximum yield was recorded in redgram + cowpea with 28.87 q/ha followed by redgram + soybean with 25.81 q/ha of yield were significantly superior over untreated check. Among the intercrops redgram + Niger recorded lowest yield of 11.96 q/ha which was on par with untreated check (11.22 q/ha) are given in table 2.

Table 2: Yields in different intercropping systems

Sl. No	Treatment	Row ratio	Yield of main crop (q/ha)	Yield of inter crop (q/ha)	Price of intercrops (Rs. /q)	REY* (q/ha)
T_1	Redgram + Cowpea	1:3	20.78 (4.61)^{ab}	10.78	4200	28.87
T_2	Redgram + Soybean	1:3	19.33 (4.44)^{bc}	10.67	3399	25.81
T_3	Redgram + Greengram	1:3	16.11 (4.06)^{cd}	6.67	6700	24.09
T_4	Redgram + Niger	1:3	10.56 (2.41)^{f}	1.33	5877	11.96
T_5	Redgram + Sesamum	1:3	16.22 (4.09)^{cd}	2.00	6249	18.45
T_6	Redgram + Navane	1:3	17.56 (4.25)^{bcd}	6.33	2800	20.73
T_7	Redgram + Sorghum	1:3	14.22 (3.83)^{de}	7.00	2450	17.28
T_8	Transplantation of redgram	-	23.00 (4.85)^{a}	-	-	23.00
T_9	Untreated check	-	11.22 (3.42)^{e}	-	-	11.22
	SEm±		0.16			

	CD (P=0.05)		0.48			
	CV (%)		6.73			

Seed cost of Pigeonpea (Rs. /kg) = 75 Pigeonpea (Rs. /q) = 5600
*REY- Redgram equivalent yield of system
In a columns means are significantly different as per DMRT (0.05%)
Values inside parentheses are transformed values

4. Discussion

Intercropping is an ecofriendly approach to manage the insect pests with limited use of chemicals. By considering the feasibility of intercropping, seven crops were selected and intercropped with redgram. Also, one treatment as a transplanted to know the incidence trend, damage and yield loss by gall weevil.

The intercropping combination, redgram + cowpea showed minimum infestation of gall weevil and highest percent reduction in number of galled plants and next best was redgram + soybean and redgram + sesamum. Intercrops like sorghum, green gram, navane, niger also showed less incidence of gall weevil on redgram compare to control but not significantly lesser. The less influence on percent reduction in number of galled plants was showed in redgram + greengram intercropping system. In transplanted crop infestation was more compared to intercrops. It indicates that cowpea and soybean reduces the gall weevil incidence on redgram. These findings are in line with Krishna Naik and Lingappa (1995) [3], as they reported that redgram intercropped with soybean reduced the gall weevil incidence. Similarly, Hugar (2001) [2] also reported the redgram intercropped with cowpea and soybean showed lesser damage against gall weevil, *A. collaris*.

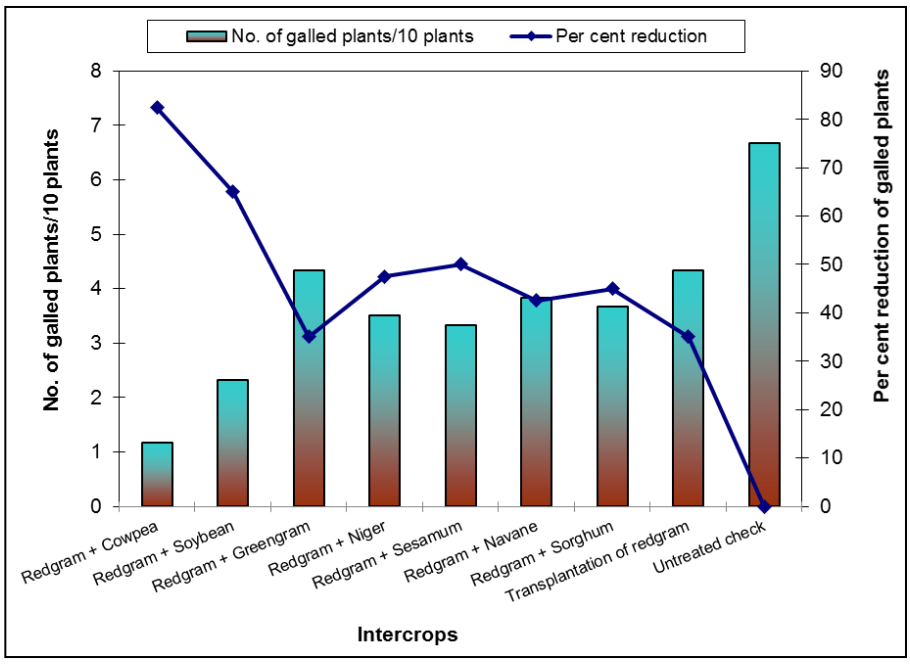

Fig 1: Influence of intercropping on occurrence gall weevil in pigeonpea

The different treatments showed varied yield levels in the management of gall weevil. Transplanted redgram proved to be best in yielding even though the incidence was high. Among the intercropping treatments, the redgram intercropped with cowpea showed highest yield. The next best intercropping systems are redgram + soybean with good yield compared to sole redgram (control). Redgram intercropped with Niger and sorghum recorded less yield. Redgram equivalent yield of intercrop was significantly higher in redgram + cowpea intercropping system. Among the treatments, highest net return was recorded in redgram + cowpea intercropping system. Redgram intercropped with soybean and greengram gained next highest benefit. The least net return observed in redgram + sesamum, redgram + sorghum and redgram + Niger. An equivalent yield of intercrop which is added to yield of the redgram was highest in the redgram + cowpea intercropping system as confirmed by Hugar (2001) [2].

5. Conclusion

Investigation on the management of gall weevil *Alcidodes collaris* by using different intercrops declared that redgram intercropped with cowpea, soybean, sesamum, niger significantly reduced the gall weevil incidence with less number of galled plants per plot. The adults attack basal portion of the stem at early stage of the crop. Later, as the crop grows, it damages tender shoots and growing tips as it always prefers tender parts. The intercrops like cowpea and soybean showed very effective in minimizing pest incidence. Redgram intercropped with cowpea and soybean proved to be best in yielding.

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