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Studies on the influence of ecological intensification practices on yield attributes and yield of greengram

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Abstract
Field experiment was carried out at Department of Millets, Tamil Nadu Agricultural University, Coimbatore during *Kharif*, 2017 in sandy clay loam soil to study the influence of ecological intensification practices on yield attributes and yield of greengram. The results revealed that Ecological Intensification (EI) practice resulted in higher grain yield (832 kgha^{-1}), net return (Rs. 23,778/ha) and BC ratio (1.80) in greengram.

Keywords: greengram, ecological intensification (EI), growth and yield

Introduction
The era of green revolution paved the way for intensive agriculture which involves growing of high yielding varieties or hybrids, usage of inorganic fertilizers, pesticides, fungicides etc. This has resulted in remarkable increase in productivity of crops. Nevertheless, the soil quality has deteriorated over the years with a negative impact on the environment through their multivarious influence. (Bender *et al*., 2016) [1]. To solve these problems and to improve the crop productivity, adoption of ecological intensification approach is highly essential. It is the environment friendly approach which replaces anthropogenic inputs and / or enhances crop productivity by including agricultural practices that promote regulating and supporting ecosystem services. (Cassman, 1999, Bommarco *et al*., 2013, Tittonell, 2014) [2-4].
Various technological interventions or strategies *viz*., organic farming, minimum or no tillage, conservation agriculture etc. are being recommended for ecological intensification. (Hobbs *et al*., 2008, Doltra and Olesen, 2013, Reganold and Wachter, 2016) [5-7]. Hence, the present experimentation was conducted to study the influence of ecological intensification practices on yield attributes and yield of greengram.

Materials and Methods
Field experiment was carried out at Department of Millets, Tamil Nadu Agricultural University, Coimbatore during *Kharif*, 2017 to develop the ecological intensification practices that could improve the current farmer practice in greengram while reducing the climatic risk. The soil was low in available N and P and high in available K. The experiment was laid out in a Randomized Complete Block Design (RCBD) with the following treatments *viz*., T_1 - Farmer practice, T_2 - Ecological Intensification (EI) which includes retaining residue of previous crop, FYM at 12.5t/ha, 30 x 10 cm (line sowing), seed treatment with Trichoderma viride at 4g/ha and with Rhizobium and Phosphobacteria at 600g/ha,25:50:25 NPK kg/ha, spraying of pulse wonder @5kg/ha, irrigation at critical stages (Flowering and Pod formation), Pendimethalin at 3.3lit/ha as pre emergence application, HW on 30 DAS, Dimethoate at 500 ml/ha for aphid and whitefly, Indoxacarb at 333 ml/ha for pod borer, Mancozeb at 1kg/ha for rust and leaf spot, T_3 - EI minus tillage practice (Conventional tillage without residue retention), T_4 - EI minus Nutrient management (Absolute control for nutrients), T_5 - EI minus Planting density (Farmer adopted genotype and density), T_6 - EI minus Water management (farmer's practice), T_7 - EI minus Weed management (No weed management), T_8 - EI minus Disease and insect management (No management) and replicated thrice. Observations on weed density on 25 DAS, plant height, yield attributes and yield were recorded.

Results and Discussion

1. Effect of ecological intensification practices on weed density, plant height and yield attributes of greengram (Table 1)

Experimental results revealed that ecological intensification practices evinced significant influence on weed density, plant height and yield attributes of greengram. Among the different practices, T_2 - Ecological Intensification (EI), recorded significantly lesser grassy weed count (14.7 No m^2) on 25 DAS and it was on par with T_6 and T_3 but was superior to other treatments. The highest grassy weed count was recorded in T_7. The treatments failed to exert any significant effect on Sedges. Nevertheless, T_5 - EI minus Planting density (Farmer adopted genotype and density) recorded significantly lesser weed count (0.7 No m^2).In respect of broad leaved weeds, T_4 - EI minus Nutrient management (Absolute control for nutrients) recorded lesser weed count (13.3 No m^2) which was comparable with T_8 and T_2. The highest weed count was recorded in T_5.The lesser weed count was ascribed to ideal plant geometry, appropriate nutrient, pest and disease management which favoured crop growth thus suppressing the dominance of weeds. Similar view has been expressed by Rana *et al*., 2011 [8].

Table 1: Effect of ecological intensification practices on weed density, plant height and yield attributes of greengram

Treatments	Weed density(m^2) on 25DAS			Plant height at harvest (cm)	No. of pods/plant	No. of seeds/pod	100 seed weight (g)
	Grasses	Sedges	BLW				
T_1	57.3	4.0	211.3	38.2	21.7	6.6	3.5
T_2	14.7	6.0	67.3	43.1	26.1	7.5	3.9
T_3	29.3	14.7	102.7	41.3	24.6	7.3	3.8
T_4	42.0	12.7	13.3	36.2	18.8	6.2	3.2
T_5	36.7	0.7	128.7	38.3	22.0	7.0	3.6
T_6	21.3	8.0	106.0	41.0	24.2	7.1	3.7
T_7	106.0	2.7	117.3	34.3	12.3	5.9	3.4
T_8	45.3	2.7	44.0	39.6	23.5	7.1	3.8
CD(p=0.5)	20.5	NS	88.7	8.7	8.1	0.5	0.4

Among the different treatments, T_2 - Ecological Intensification (EI) recorded significantly higher plant height (43.1 cm) at harvest which was comparable with T_3,T_6,T_8,T_1,T_4 and T_5.The lowest plant height of 34.3 cm was recorded in T_7.This might be due to effective utilization of nutrients, water and solar radiation leading to more accumulation of photosynthates. The results are in accordance with the findings of Ihsanullah *et al*., 2002. [9]. In respect of yield attributes, T_2 - Ecological Intensification (EI) recorded higher number of pods/plant (26.1), seeds/pod (7.5), and 100 seed weight (3.9 g) which was comparable with T3,T5,T6 and T8.The lowest number of pods/plant, seeds/pod and 100 seed weight were observed in T_7. Appropriate plant geometry, adoption of INM, weed, pest and disease management resulted in better translocation of the accumulated photosynthates which favoured the crop with more number of yield attributing characters. The results confirm the findings of Naeem *et al*. (2006), Ahmad *et al.* (1992) and Hussain (1994) [10-12].

2. Effect of ecological intensification practices on yield and economics of greengram (Table 2)

In respect of yield, T_2 - Ecological Intensification (EI) recorded higher grain yield (832 $kgha^{-1}$), which was comparable with T_3, T_6 and T_8 but was significantly superior to other treatments. The lowest yield of 408 kg ha^{-1} was recorded in T_7.This might be due to better yield attributing characters which eventually increased the yield of greengram. The results confirms the findings of Patel and Pramer, 1986 and Sultana *et al*. (2009) [13-14]. The highest net return of Rs. 23,778/ha and BC ratio of 1.80 was registered in T_2.

Table 2: Effect of ecological intensification practices on yield and economics of greengram

Treatments	Grain yield ($kgha^{-1}$)	Net return ($Rs.ha^{-1}$)	B:C ratio
T_1	594	14971	1.63
T_2	832	23778	1.80
T_3	811	22360	1.75
T_4	512	7024	1.27
T_5	706	17866	1.65
T_6	796	21330	1.72
T_7	408	4149	1.18
T_8	772	19816	1.67
CD (p=0.05)	104	-	-

Conclusion

Based on the results, it is concluded that Ecological Intensification (EI) practice resulted in higher grain yield (832 $kgha^{-1}$), net return (Rs. 23,778/ha) and BC ratio (1.80) in greengram.

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