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Response of groundnut to integrated nutrient and weed management practices on weeds, growth and yield

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Abstract

The field experiments were made in irrigated groundnut to optimize the integrated nutrient and weed management practices for augmenting groundnut productivity at farmers field Sananandal village, Tiruvannamalai District, Tamilnadu, India. The experiment was laid out in split plot design with three replications. The details of the treatment in main plots are M_1-RDF, M_2- -RDF + vermicompost @5 t ha^{-1} , M_3- -RDF +FYM @ 12.5 t ha^{-1}, M_4- -RDF + coirpith @ 12.5 t ha^{-1} and the subplots are S_1- weedy check, S_2- weed free, S_3- hand weeding twice (20DAS and 45DAS), S_4- pre sowing pendimethalin @3.3 l ha^{-1} + hand weeding at 30 DAS , S_5- pre emergence Diclosulam @ 30.9 g ha^{-1} + hand weeding at 30 DAS , S_6 post emergence Imazethepyr @ 750 ml ha^{-1} + hand weeding at 40 DAS , S_7 – Pre sowing Pendimethalin @ 3.3 l ha^{-1} + Post emergence Imazethepyr @ 750 ml ha^{-1}. The results of the study evidently proved that RDF + vermicompost (M_2) recorded highest growth and yield parameters in main plot. And pre emergence application Diclosulam + hand weeding at 30 DAS (S_5) recorded lowest weed population in subplot. It can be concluded that application of recommended RDF + vermicompost along with pre emergence Diclosulam + hand weeding at 30 DAS (M_2S_5) as an agronomically efficient , eco-friendly and economically viable technology for improving groundnut growth and yield parameter. This treatment (M_1S_1) combination registered lowest values for weed density, weed biomass and maximum weed control index and maximum values for growth, yield parameter and yield of groundnut.

Key words : Groundnut, weeds, growth and yield quality and nutrient uptake.

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Groundnut of peanut (*Arachis hypogea* L.) also known as 'King of oilseed'[2] belongs to family Fabaceae. Groundnut is an important oilseed crop and food grain legume crop of India. Commercially it is thirteenth most important food crop, Fourth most important source of vegetable oil and third main source of vegetable protein in the world. Its seed includes a high grade of 45-50 per cent edible oil, 25-39 percent protein, 20 percent carbs and 5 per cent fiber and ash, all of which contribute to human nutrition on a long term basis[3]. Groundnut naturally enriches the soil through biological nitrogen fixation. The continuous and imbalance use of chemical fertilizers affects production potential of groundnut. Use of chemical fertilizers in combination with organic manures results in the higher productivity of groundnut crop and improves the soil health. Organic manures are good complimentary sources of nutrients[5]. INM enhances crop yields by 8-150% compared with conventional practices increases water-use efficiency and the economic returns to farmers, while improving grain quality and soil health and sustainability[7].

Weeds are the major cause of minimizing production and yield losses in groundnut[4] to an extent of 13-80%. Groundnut is highly susceptible to weed infestation due to its slow growth rate in the initial stages up to 45 DAS which causes shortening of plant height and underground pod bearing habit[12]. Pre plant or pre emergence chemical weed management using selective herbicides like pendimethalin followed by one hand weeding is a common practice in groundnut. However, disturbing the soil during manual weeding. In the early stages, exposes the groundnut crop to new flushes of weeds. These late emerging weeds seriously affect the pegging and pod development and disrupt digging and harvesting operations and difficult to strip the pods from vines[13]. Chemical weed control although is one of the effective methods, continuous use of herbicides for weed control leads to residue hazards, weed shift and build of resistance in weed. In order to minimize the losses caused by weeds some new herbicides suitable for groundnut has been developed. In these conditions herbicide in combination with cultural practices offers economically suitable and effective weed control in groundnut[10].

The Field experiments were conducted to study the effect of integrated nutrient and weed management on groundnut at farmers field, Sananandal village, Tiruvannamalai District, Tamil Nadu. The soil of experimental field was sandy clay loam with low in available nitrogen (203.5 $kgha^{-1}$), medium in available phosphorus (8.11 $kgha^{-1}$), high in available potassium (306.0 $kgha^{-1}$). The groundnut genotype were selected for JL-24. The pH and E.C. were 7.13 and 0.11 dsm^{-1} respectively. The experiment was laid out in split plot design with three replication. The details of the treatments in main plots are M_1-RDF, M_2-RDF + Vermicompost @5 t ha^{-1}, M_3-RDF+FYM @12.5 t ha^{-1} and M_4-RDF + coirpith @ 12.5 t ha^{-1} and the subplots are S_1-weedy check, S_2-weed free, S_3-HW twice at 20 and 45 DAS, S_4- pre sowing Pendimethalin @ 3.3 l ha^{-1} + HW at 30 DAS, S_5-pre emergence Diclosulam @ 30.9 g ha^{-1} + HW at 30 DAS, S_6- Post emergence Imazethepyr @ & 750 ml ha^{-1} + HW at 40 DAS, S_7-Pre sowing Pendimethalin @ 3.3 l ha^{-1} + Post emergence Imazethepyr @ 750 ml ha^{-1}. Recommended dose of 25:50:75

kg of NPK ha^{-1} was applied. N was applied in the form of urea, while phosphorus and potassium were applied in the form of SSP and MOP respectively. Weed management practices were carried out as per the treatment schedule. The preplant incorporation of pendimethalin, pre emergence application of Diclosulam, Post emergence application of Imazethepyr at required dose were done using the hand operated knapsack sprayer fitted with a flood a jet nozzle. A spray volume of 500 liters of water was used per hectare.

Weeds :

The nutrient management treatments significantly influenced the weed characters in groundnut. Among the nutrient management practices tried, the treatment M_2 (RDF+ vermicompost) recorded lower weed population 9.58 (91.33) and 11.32 (127.69) m^{-2}, lesser weed biomass 135.67 and 188.76 higher weed control index (55.86% and 48.97%) at 30 and 60 DAS. The reason for low weed population under these treatments might be due to better uptake of nutrients by the crop from the initial stage and did not provide enough time for the weeds to utilize the nutrients and other factors. Similar result was reported by Kalaiyarasan *et al.*,[6]. This was followed by M_4 (RDF + coirpith). Highest values for weed density and weed biomass were recorded in M_1 (RDF).

Profound influence on weed count was noticed due to weed management treatments. Among the different weed management practices tried, S_5 (Diclosulam + HW at 30 DAS) registered the lowest weed count 10.40 (107.76) and 12.31 (150.94) m^{-2}, lowest weed biomass (161.04 and 224.17), highest weed control index (47.60%, 39.61%) at 30 and 60 DAS. It may be due to the efficiency of the herbicide in suppressing the germination of weed seeds at time of sowing. This findings is in conformity with the studies of Kumar *et al.*,[8]. The weedy check (S_1) treatment recorded higher weed density, weed biomass and higher weed lower weed control index at all the stages of crop growth. This is due to poor weed management.

Significant interactions were noticed between the nutrient and weed management practices in groundnut. The interaction between nutrient management (M_2) with the weed management, treatment (S_5) proved their efficiency by registering lowest weed density, biomass by weeds and maximum weed control index. This might be due to the herbicidal effect of Diclosulam inhibit the cell division through tubulin inactivation mechanism which might have curtailed the density and growth of weeds[8].

Crop Growth attributes :

Among the nutrient management practices tried, the treatment M_2 (RDF+ vermicompost) recorded maximum plant height (49.80 cm) at harvest stage, leaf area index (4.53) at 60 days and dry matter production (6704.14 $kgha^{-1}$) at harvest stage. The maximum values of growth attributes under M_2 might be production of vigorous plants due to synergistic and cumulative effect of organics and inorganics. Lowest plant height, leaf area index and dry matter production recorded M_1 (control) in all stages of crop growth. This is due to low uptake of nitrogen, phosphorus and potassium in this treatment due to absence of all the nutrients[5].

Among the weed management treatments, S_2 (weed free) recorded, maximum values of all the growth parameters. Among herbicide treatment, significantly higher plant height was recorded with application of S_5 (Diclosulam+30 DAS HW) recorded maximum plant height (48.07 cm) at harvest stage, leaf area index (4.35) at 60 days, Dry matter production (6296.17 kg ha^{-1}) at harvest stage was next in order. The reason for the better performance of these treatments might be due to effective control of weeds, which might have reduced the stiff competition for nutrients, moisture, space and radiant energy and have encouraged higher uptake of nutrients and better utilization of other resources by the crop[9]. This was followed by the treatment S_6 (Imazethepyr+ HW at 40 DAS). The minimum values for plant height, leaf area index and dry matter production recorded under S_1 (weedy check) in all the stages of crop growth.

The interaction effect between the nutrient and weed management on plant growth attributes were significant. Treatment M_2 (RDF+Vermicompost) with S_5 (Diclosulam +HW at 30 DAS) recorded maximum plant height (55.56 cm), leaf area index (5.12) at 60 days, Dry matter production (8303.81 $kgha^{-1}$) at harvest stage. Lowest plant height, leaf area index and dry matter production recorded under M_1S_1 (control) in all stages of crop growth.

This might be due to the effective interaction between the nutrient and weed management treatments, which could have increased the availability of better nutrition from vermicompost along with the effective control of weeds by the respective treatments. Similar trends of results was reported by Kumar *et al.,*[8].

Yield :

Among the nutrient management practices tried M_2 (RDF+vermicompost) recorded higher Pod yield (2179 $kgha^{-1}$) and haulm yield (4298 $kgha^{-1}$) over other treatments. The appreciable increase obtained in growth parameters reflected in yield[11]. This was followed by M_4 (RDF+coirpith). M_1 (RDF) recorded lower Pod yield (1254 $kgha^{-1}$) and haulm yield (2553 $kgha^{-1}$).

Among the weed management treatments S_2 (weed free) registered higher values on yield components on recorded a maximum pod yield of (2263 $kgha^{-1}$). Whereas, significantly higher growth and yield was recorded in weed free check. Among herbicide treatment S_5 (Diclosulam +HW at 30 DAS) registered higher Pod yield (2036 kg ha^{-1}) and haulm yield (4047 $kgha^{-1}$) over other treatments. This might be due to sustained availability of nutrients to the crop as a results of effective control of weeds at the appropriate crop growth stages. This was followed by S_6 (Preplant incorporation Pendimethalin + Post emergence Imazethepyr).Weedy check (S_1) recorded lowest pod yield and haulm yield. The interaction effect between the nutrient and weed management was significant. Treatment M_2 (RDF+Vermicompost) with S_5 (Diclosulam +HW at 30 DAS) registered higher pod yield (2715 kg ha^{-1}), haulm yield (5308 kg ha^{-1}) over the other treatments. This was followed by M_2S_6 and lowest yield was recorded by M_1S_1 pod yield and haulm yield. These findings are

Table-1. Effect of integrated nutrient and weed management practices on weed characters of groundnut

Treatments	Total weed population (M^2)		Total weed biomass (kg ha^{-1})		WCI (%)	
Main plot	30 DAS	60 DAS	30 DAS	60 DAS	30DAS	60DAS
M1	13.30 (176.57)	14.55 (211.28)	275.19	329.28	10.46	11.33
M2	9.58 (91.33)	11.32 (127.69)	135.67	188.76	55.86	48.97
M3	11.34 (128.14)	12.79 (162.96)	197.79	251.49	35.64	32.05
M4	10.58 (110.95)	12.11 (146.19)	165.1	202	46.28	41.52
S.Ed	1.28	1.64	1.95	10.37		
CD	3.13	4.00	4.78	25.37		
Sub Plot						
S1	14.06 (197.26)	15.46 (238.56)	307.33	371.64	0	0
S2	0.00	0.00	0	0	100	100
S3	11.77 (138.09)	13.39 (178.67)	205.67	265.18	33.08	28.21
S4	12.28 (150.40)	13.84 (190.97)	232.39	294.95	24.38	20.21
S5	10.40 (107.76)	12.31 (150.94)	161.04	224.17	47.6	39.61
S6	11.22 (125.43)	12.95 (167.31)	186.99	248.38	39.16	32.75
S7	12.99 (168.28)	14.43 (207.79)	260.68	295.86	15.18	13.48
S.Ed	1.55	1.98	2.36	14.33		
CD	3.11	3.97	4.74	28.81		

Table-2. Effect of integrated nutrient and weed management practices on growth and yield of groundnut

Treatments	Plant height (cm) (At harvest)	LAI (At 60 days)	DMP (Kg ha^{-1}) (At harvest)	Pod yield (Kg ha^{-1})	Haulm yield (Kg ha^{-1})
Main Plot					
M1	38.42	3.21	3939.51	1254	2553
M2	49.8	4.53	6704.14	2179	4298
M3	44.73	3.98	5412.46	1741	3489
M4	46.45	4.18	5827.79	1882	3749
S.Ed	0.45	0.04	55.26	17.82	35.58
CD	1.11	0.099	135.23	43.6	87.06
Sub Plot					
S1	38.64	3.24	4011.14	1268	2607
S2	50.78	4.65	6951.58	2263	4454
S3	44.73	3.97	5408.13	1746	3479
S4	43.56	3.83	5111.61	1644	3295
S5	48.07	4.35	6296.17	2036	4047
S6	46.44	4.19	5850.6	1886	3767
S7	41.76	3.61	4667.59	1504	3006
S.Ed	0.55	0.05	66.74	21.52	42.97
CD	1.1	0.10	134.19	43.26	86.39

in conformity with the findings of Bijarnia *et al.*,[1]. These results indicated that integrated nutrient management under comparatively weed free environment can influence the groundnut yield components and pod yield significantly.

On the basis of the above results, it may be concluded that various nutrient and weed management practices have produced profitable yield in groundnut. Moreover, higher pod yield contributing factors of groundnut was observed when the plots were incorporated M_2 (RDF+Vermicompost 5 tonne ha^{-1}) with S_5 (Diclosulam +HW at 30 DAS). Hence application of vermicompost with Diclosulam can be recommended for the groundnut cultivation. This was found to be the most efficient, cost effective and sustainable agronomic practices for increasing the pod yield of groundnut.

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