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Effect of integrated nutrient management and weed control practices on weeds, growth and yield in groundnut

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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 soil of the experimental site was sandy clay loam in texture with pH of 7.11, organic carbon of 0.37% having available soil nitrogen, phosphorus and potassium of 214.4 kg ha^{-1}, 8.28 kg ha^{-1} and 306.8 kg ha^{-1} respectively. Groundnut crop (var. JL-24) was sowing in *kharif* season taking four levels of nutrient management practice and seven level of weed management. The experiment was laid out in split plot design with three replications. The pooled data revealed that growth of groundnut and yield parameter were significantly higher in treatment of RDF + vermicompost @5 t ha^{-1} with pre emergence application of herbicide Diclosulam followed hand weeding at 30 DAS (M_2S_5) which recorded higher plant height (51.57 cm), LAI (4.61), dry matter accumulation (7909 kg ha^{-1}), pod yield (2474 kg ha^{-1}) and haulm yield (5168 kg ha^{-1})as an agronomically efficient , eco- friendly and economically viable technology for improving groundnut growth and yield parameter. This treatment (M_2S_5) 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, vermicompost, FYM, composted coirpith, pendimethalin, diclosulam and Imazethepyr.

Groundnut (*Arachis hypogaea* L.) is an annual legume crop and it's native from South America. Groundnut has a useful role in offspring deficiencies as a rich source of edible oil and protein which play an important position in Indian diet. Hence groundnut is known as king of oilseed crops[2] 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 per cent protein, 20 per cent carbs and 5 per cent fibre and ash, all of which contribute to human nutrition on a long

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term basis[3]. The plant nutrients which play most important role in the nutrition of groundnut crop are nitrogen, phosphorus and potassium. Groundnut is highly responsive to fertilizer application, although groundnut being a legume is capable of fixing atmospheric nitrogen. On Contrary groundnut frames use very less fertilizers resulting in severe mineral nutrients deficiencies dut to inadequate and imbalance use of nutrients is one of the major factors responsible for low yield groundnut. Organic manures are good complimentary sources of nutrients[6].

Weeds are the major cause of minimizing production and yield losses in groundnut[5] to an extent of 13-80%. For groundnut, there should be a weed free condition up to 40 DAS otherwise the reduction in growth and yield can't be compensated at later stage due to severe weed infestation. Thus, a field experiment was formulated to evaluate suitable integrated weed management practices for increasing weed control efficiency and reducing labour usage in groundnut production. 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[12]. 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 (214.4kg ha^{-1}), medium in available phosphorus (8.28 kg ha^{-1}), high in available potassium (306.8 kg ha^{-1}). The groundnut genotype JL-24 was selected. The pH and E.C. were 7.11 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 + composted 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 plant incorporation of 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 plant incorporation of 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 9.30 (85.91) and 11.20(125.04) m^{-2}, lesser weed biomass 127.63 and 184.66 higher weed control index (55.80% and 48.40%) 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.,*[7]. This was followed by M_4 (RDF + composted 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 10.12(101.99) and 12.23(148.96) m^{-2}, lowest weed biomass (152.39 and 221.05 kg ha^{-1}), highest weed control index (47.23%, 38.23%) at 30 and 60 DAS. It might 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. Nitrogen supplementation with vermicompost was more efficient in reducing the N uptake by weeds as compared to 'N' application through inorganic fertilizer (100% NPK)[4]. 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 parameter :

Among the nutrient management practices tried, the treatment M_2 (RDF + vermicompost) recorded maximum plant height (46.27 cm) at harvest stage, leaf area index (3.94) at 60 days and dry matter production (6397 kg ha^{-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[6].

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 + HW at 30 DAS) recorded maximum plant height (44.76 cm) at harvest stage, leaf area index (3.74) at 60 days, Dry matter production (6039 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 (51.57 cm), leaf area index (4.61) at 60 days, Dry matter production (7909 kg ha^{-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 (2031 $kgha^{-1}$) and haulm yield (4204 $kgha^{-1}$) over other treatments. The appreciable increase obtained in growth parameters reflected in yield[11]. This was followed by M_4 (RDF+ composted coirpith). M_1 (RDF) recorded lower Pod yield (1206 kg ha^{-1}) and haulm yield (2497 kg ha^{-1}).

Among the weed management treatments S_2 (weed free) registered higher values on yield components and recorded a maximum pod yield of (2108 $kgha^{-1}$). 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 (1905 kg ha^{-1}) and haulm yield (3930 $kgha^{-1}$) 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 (2474 kg ha^{-1}), haulm yield (5168 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 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.

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
M_1	12.96 (167.44)	14.32 (204.69)	260.96	319.00	9.63	10.86
M_2	9.30 (85.91)	11.20 (125.04)	127.63	184.66	55.8	48.4
M_3	11.00 (120.57)	12.55 (156.93)	186.11	242.17	35.55	32.33
M_4	10.14 (102.31)	11.91 (141.30)	152.39	209.44	47.23	41.47
S.Ed	1.20	1.59	1.84	2.41		
CD(p=0.05)	2.94	3.88	4.49	5.90		
Sub Plot						
S_1	13.63 (185.35)	15.17 (229.70)	288.77	357.85	0	0
S_2	0	0	0	0	100	100
S_3	11.32 (127.55)	13.17 (172.90)	190.17	256.45	34.14	28.34
S_4	11.98 (143.03)	13.58 (183.83)	221.01	283.93	23.47	20.66
S_5	10.12 (101.99)	12.23 (148.96)	152.39	221.05	47.23	38.23
S_6	10.83 (116.76)	12.77 (162.70)	174.19	241.37	39.68	32.55
S_7	12.62 (158.73)	14.19 (200.85)	245.90	311.08	14.85	13.07
S.Ed	1.45	1.92	2.22	2.91		
CD(p=0.05)	2.92	3.85	4.46	5.86		
M at S						
S.Ed	2.94	3.88	4.5	5.91		
CD(p=0.05)	6.13	8.09	9.37	12.31		
S at M						
S.Ed	2.9	3.83	4.44	5.83		
CD(p=0.05)	5.84	7.7	8.92	11.72		

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 DAS)	DMP (kg ha^{-1}) (At harvest)	Pod yield (kg ha^{-1})	Haulm yield (kg ha^{-1})
Main Plot					
M_1	37.52	2.67	3832	1206	2497
M_2	46.27	3.94	6397	2031	4204
M_3	41.76	3.36	5213	1651	3386
M_4	43.25	3.56	5618	1776	3652
S.Ed	0.43	0.03	53.18	16.83	34.69
CD(p=0.05)	1.04	0.08	130.14	41.18	84.9
Sub Plot					
S_1	37.32	2.69	3900	1221	2547
S_2	47.18	4.05	6592	2108	4356
S_3	41.84	3.37	5215	1651	3388
S_4	41.24	3.23	4940	1562	3210
S_5	44.76	3.74	6039	1905	3930
S_6	43.31	3.57	5623	1776	3657
S_7	39.76	3.03	4545	1438	2953
S.Ed	0.51	0.08	64.22	20.32	41.9
CD(p=0.05)	1.04	0.18	129.14	40.86	84.25
M at S					
S.Ed	1.04	0.08	130.27	41.22	84.98
CD(p=0.05)	2.18	0.18	271.41	85.88	177.06
S at M					
S.Ed	1.03	0.08	128.45	40.64	83.8
CD(p=0.05)	2.07	0.17	258.27	81.72	168.49

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 Recommended Dose Fertilizer +Vermicompost 5 t ha^{-1} + Diclosulam + Hand weeding at 30 DAS. 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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