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Weed Pressure on Growth and Yield of Groundnut (*Arachis hypogaea* L.) in Meghalaya, India

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A B S T R A C T

In two consecutive seasons a field experiment was conducted in randomised block design replicated thrice with twelve treatments including two sets of treatments, *viz.* initial weedy and initial weed free treatment with 15 days interval up to harvesting. They are weeds up to 15, 30, 45, 60, 75 days after emergence (DAE), weedy treatment and weed free up to 15, 30, 45, 60, 75, weed free treatment to assess the effect of weed flora on growth and yield of groundnut. The results show that the growth parameters like Plant height (59.80, 50.56 and 55.18 cm), Dry matter (28.12, 24.49 and 26.3 g/plant), LAI (2.56, 2.47, 2.51) and yield attributes of groundnut were significantly with increasing of initial weed free treatments and highest number of pods per plant (22.20, 16.52 and 18.80), number of seeds per pod (1.90, 1.80 and 1.85), seed index (24.01, 23.52 and 23.59), seed yield (1.35, 0.94 and 1.15 t/ha) and STOVER yield (3.87, 3.37 and 3.62 t/ha) and Harvest index (50.24, 21.84 and 23.86%) were found in weed free check. Similarly, lowest was found in weedy check in both season.

Introduction

Groundnut, known as king of oilseeds grown in India and is one of the most important food as well as cash crop of our country. It is gaining importance due to its contents namely, 48-50% of oil and 26-28% of protein. It's photo insensitive, mid-season drought tolerant and has wide range of adaptability to various agro-climatic situations. Globally, Groundnut is grown on an area of 24.38 million ha, 40.78 million metric tons of production with 1.67 metric tons productivity during 2016 (FAS/USDA, 2016). In India, it is cultivated over an area of 4.50 million hectares, with a production of 4.70 million metric tons. However, its productivity is low (1.04 metric tons per hectares) when compared to worlds' average productivity (FAS/USDA, 2016).

During crop growth, many weeds cause losses in groundnut yield by competing for water, space, light and nutrients with crop. It is necessary to maintain the crops in a weed-free condition during the critical period for crop-weed competition to maintain high yields

(Islam *et al.*, 2016). So if it is weed-free at initial stage of crop growth, then the weeds that come up later are also suppressed, resulting in lower weed density leading to vigorous growth of the crop. In rice field, weeds especially barnyard grass at later stage competes for light and getting higher light use efficiency as well as shades the crop and reduces the quality and quantity of light received by rice plant as compare to initial stage of crop growth (Concenco *et al.*, 2009). Under consideration of these things, going to evaluate what are the effects of weeds and there density on growth and yield of groundnut in Meghalaya.

Materials and Methods

The experiment was conducted at experimental farm of the College of Postgraduate Studies (CAU), Umiam, Meghalaya, India in both *Kharif* and *Rabi* seasons of the year 2016-17. The experimental site was located at 091°54.72' E longitude and 25°40.886' N latitude and at an altitude of 950 m above the mean sea level (MSL). The soil of the experimental site is sandy clay loam in texture. pH (4.9), Organic carbon (0.77%), NPKS (282.24, 13.04, 241.98, 1.6 kg/ha). The experiment was conducted in a randomized block design, replicated thrice with twelve treatments, *viz.* weeds until 15 DAE, weeds until 30 DAE, weeds until 45 DAE, weeds until 60 DAE, weeds until 75 DAE, weedy treatment and weed free until 15 DAE, weed free until 30 DAE, weed free until 45 DAE, weed free until 60 DAE, weed free until 75 DAE, weed free treatment. 'ICGS-76' is the variety of Groundnut was sown in June 23 (*Kharif*), and November 22 (*Rabi*) during both the experimental seasons with plant spacing of 40 x 10 cm^2 on flat beds. Recommended doses of N, P and K = 25:60:60 NPK kg/ha (Full doses N, P and K were applied at the time of sowing) Standard agronomic practices were followed during crop growth period and crop was harvested after physiological maturity. Randomly, ten plants were selected from each plot and regular biometric observations were taken for growth and yield of crop at DAE to harvest with an interval of 15 days.

The analysis of data was done using the Fisher's method of analysis of variance technique as described by Gomez and Gomez (1984). The differences of means were identified by Duncan's univariate test at $P \geq 0.05$.

Results and Discussion

The most dominated weed floras in both experimental seasons was listed in Table 1. Grassy weeds are most dominated weed spices in both seasons of groundnut.

Plant height

The results of plant height data was shown in Table 2. Different weedy and weed free treatment was significantly affected on plant height. The highest plant height was found in season long weed free treatment with 68.15, 57.76 and 62.95 in *Kharif*, *Rabi* and *Pooled*, respectively. The competitive ability of the groundnut increased with the increasing space occupied by the plants as well as weeds. Weeds grow faster than groundnut at initial stage and cover the plant canopy and the lower space reduces the resource availability by the individual plant, this might be reducing the height of groundnut plant. However, the height of weeds increased with respect to its dominance over the crop. Thus, cumulative effect decreased the height of the groundnut plant. Hakim *et al.*, (2013) observed that the plant height of rice was significantly influenced by weed competition period, increased the length of weed interference and caused shortest plant. The taller plants were found in weed free check while the weedy check treatment resulted in shorter plants.

Dry matter accumulation (g/plant)

The dry matter accumulation in the plant increased with progression of growth period of the groundnut during both seasons of the experimentation. Further, the dry matter accumulation of *Kharif* season was higher than the *Rabi* irrespective of its growth stages.

Weed free check treatment accumulated higher dry matter with 28.12, 24.49 and 26.3 g/plant at harvest in *Kharif, Rabi* and *Pooled*, respectively than the other periods of weed free and weedy plots. However, the lowest production was associated with the weedy plots. Due to accumulation of large quantity of dry matter by plants with better leaf canopy development, which made the plants to utilize the available resources more efficiently for photosynthesis and translocation to different parts, which intern resulted in higher dry matter production. Karkanis *et al.*, (2012) reported that the dry weight of parsley reduced with increasing duration of weed pressure, confirming the high sensitivity of the parsley crop to weed interference.

Leaf area index

The leaf area index of groundnut was significantly affected by increasing the length of weed interference period and, conversely favourably influenced by the increasing span of weed free period, up to 75 DAE during both *Kharif* and *Rabi* season. Further, at 75 DAE the greater leaf area index was observed in season long weed free treatment with 2.56, 2.47, 2.51 in *Kharif, Rabi* and *Pooled*, respectively. However, the lowest leaf area index was observed in weedy treatment.

Table.1 Weed composition of Groundnut in two season of the experiment

Sl. No	Scientific name	Common name	Kharif	Rabi
1	*Ageratum conyzoides*	Nilam (Goat weed)	+	+
2	*Ageratum houstonianum*	Goat weed	+	+
3	*Amaranthus spp.*	Pigweed	-	+
4	*Ambrosia artemisiifolia*	Stick weed	+	+
5	*Bidens pilosa*	Spanish needle	+	+
6	*Borreria hispida*	Thaarthaval	+	+
7	*Borreria latifolia*	Broadleaf button weed	+	+
8	*Celosia argentina*	White cock's comb	-	+
9	*Commelina bengalensis*	Benghal dayflower	+	-
10	*Cynodon dactylon*	Bermuda grass	+	+
11	*Cyperus iria*	Yellow nut sedge	+	-
12	*Cyperus rotundus*	Purple nut sedge	+	+
13	*Dactyloctenium aegyptium*	Crow foot grass	-	+
14	*Digitaria cillaris*	Southern crabgrass	+	+
15	*Digitaria marginata*	Finger grass	+	-
16	*Digitaria sangvinalis*	Crabgrass	+	+
17	*Echinochloa colonum*	Swanki	+	+
18	*Echinochloa crusgalli*	Barnyard grass	+	+
19	*Eleusine indica*	Goose grass	+	+
20	*Galinsoga parviflora*	Potato weed	+	+
21	*Mimosa pudica*	touch me not	+	+
22	*Panicum psilopodium*	Barefoot panicgrass	+	-
23	*Panicum trypheron*	Panic grass	+	-
24	*Spermotica latifolia*	False button weed	+	+

[+] weed present and [-] weed missing

Table.2 Effect of different weedy and weed free periods on groundnut Plant height, Dry matter content (at harvest) and Leaf area index (at 75 DAE)

Treatments	Plant height (cm)			Plant dry matter (g)			LAI		
	Kharif	Rabi	Pooled	Kharif	Rabi	Pooled	Kharif	Rabi	Pooled
Weeds until 15 days	60.08abc	50.81ab	55.44b	20.83b	19.11c	19.97de	2.42bc	1.58de	2.00cde
Weeds until 30 days	58.98abc	50.07ab	54.53b	17.78bc	18.20cd	17.99e	2.35c	1.56de	1.96cde
Weeds until 45 days	57.05abc	48.36ab	52.71b	16.56cd	13.06f	14.81f	2.35c	1.44e	1.89de
Weeds until 60 days	56.21abc	47.56ab	51.89bc	15.53cd	11.29f	13.41fg	2.18d	1.44e	1.81e
Weeds until 75 days	54.90bc	46.04ab	50.47bc	13.77de	12.18f	12.98fg	2.17d	1.43e	1.80e
Weedy plot	49.68c	41.57b	45.63c	11.02e	11.63f	11.32g	2.12d	1.38e	1.75e
Weed free until 15 days	57.16abc	48.24ab	52.70b	25.10a	15.64e	20.37de	2.48ab	1.75cd	2.11bcd
Weed free until 30 days	58.42abc	49.58ab	54.00b	25.53a	18.59cd	22.06bcd	2.48ab	1.91bc	2.20bc
Weed free until 45 days	59.58abc	50.32ab	54.95b	26.25a	16.70de	21.48cd	2.49ab	2.05b	2.27ab
Weed free until 60 days	59.80abc	50.56ab	55.18b	26.52a	21.14b	23.83abc	2.52ab	2.51a	2.51a
Weed free until 75 days	62.08ab	52.95ab	57.51ab	26.77a	22.81ab	24.79ab	2.53a	2.44a	2.48a
Weed Free plot	68.15a	57.76a	62.95a	28.12a	24.49a	26.30a	2.56a	2.47a	2.51a
LSD (p=0.05)	10.59	10.08	5.19	3.41	1.96	1.40	0.09	0.26	0.10

*Figures not sharing the same letters in the same column differs significantly at p<0.05

Table.3 Effect of different weedy and weed free periods on groundnut yield components

Treatments	Number of pods per plant			Number of seeds per pod			Seed index (g)		
	Kharif	Rabi	Pooled	Kharif	Rabi	Pooled	Kharif	Rabi	Pooled
Weeds until 15 days	6.20f	12.65c	14.37bc	1.87a	1.80a	1.85a	23.67a	23.52a	23.59a
Weeds until 30 days	14.63b	11.23d	12.80d	1.73ab	1.78ab	1.82ab	21.80abc	21.79abc	21.80bc
Weeds until 45 days	13.07c	10.49e	11.72e	1.37bcd	1.57ef	1.64ef	20.83bcd	20.64bcd	20.74cd
Weeds until 60 days	11.77d	8.46g	9.99f	1.43bcd	1.68bcde	1.73cd	20.17cde	20.02cd	20.09def
Weeds until 75 days	9.47e	7.94g	9.18g	1.23cd	1.61def	1.65ef	19.52de	18.84de	19.18ef
Weedy plot	8.50e	6.99h	8.17h	1.03d	1.46g	1.50g	19.03e	18.77de	18.90f
Weed free until 15 days	8.40e	7.34h	8.29h	1.20cd	1.54fg	1.58f	18.20e	17.04e	17.62g
Weed free until 30 days	10.87d	9.19f	10.57f	1.40bcd	1.59def	1.63ef	20.00cde	19.20d	19.60def
Weed free until 45 days	12.97c	11.36d	12.81d	1.50abc	1.64cdef	1.69de	20.87bcd	19.97cd	20.42de
Weed free until 60 days	14.27b	12.78c	14.24c	1.57abc	1.69bcd	1.74cd	23.13ab	22.18ab	22.65ab
Weed free until 75 days	15.10b	13.52b	15.06b	1.73ab	1.73abc	1.77bc	23.87a	23.09a	23.48a
Weed Free plot	22.20a	16.52a	18.80a	1.90a	1.78ab	1.82ab	24.01a	23.28a	23.64a
LSD (p=0.05)	1.18	0.59	0.54	0.38	0.1	0.05	2.2	1.76	1.00

*Figures not sharing the same letters in the same column differs significantly at p<0.05

Table.4 Effect of weeds on seed and stover yield and harvest index

Treatments	Seed yield (t/ha)			Stover yield (t/ha)			HI (%)		
	Kharif	Rabi	Pooled	Kharif	Rabi	Pooled	Kharif	Rabi	Pooled
Weeds until 15 days	1.30b	0.88b	1.09b	3.62a	3.15c	3.39a	48.11d	21.84cd	24.11bc
Weeds until 30 days	1.12d	0.78d	0.95d	3.05a	2.65f	2.85a	46.83e	22.72a	24.81a
Weeds until 45 days	0.98e	0.68e	0.83e	2.98a	2.60g	2.79a	43.84g	20.76e	22.73e
Weeds until 60 days	0.86fg	0.60fg	0.73fg	2.64a	2.30i	2.47a	44.91fg	20.69e	22.63e
Weeds until 75 days	0.85g	0.59g	0.72fg	2.64a	2.29i	2.46a	41.93h	20.60e	22.53e
Weedy plot	0.82h	0.52i	0.67h	2.54a	2.21j	2.38a	51.34a	18.94g	21.63f
Weed free until 15 days	0.83h	0.56h	0.70gh	2.56a	2.23j	2.39a	45.52ef	20.22e	22.30e
Weed free until 30 days	0.88f	0.62f	0.75f	2.90a	2.52h	2.71a	46.48e	19.64f	21.52f
Weed free until 45 days	1.13d	0.77d	0.95d	3.25a	2.83e	3.04a	48.66cd	21.40d	23.55d
Weed free until 60 days	1.19c	0.83c	1.01c	3.35a	2.92d	3.13a	49.50bc	22.15bc	24.20bc
Weed free until 75 days	1.35a	0.94a	1.14a	3.73a	3.25b	3.49a	49.71bc	22.40ab	24.48ab
Weed Free plot	1.35a	0.94a	1.15a	3.87a	3.37a	3.62a	50.24ab	21.84cd	23.86cd
LSD (p=0.05)	0.03	0.02	0.01	NS	0.04	NS	1.27	0.51	0.28

*Figures not sharing the same letters in the same column differs significantly at p<0.05

Weed floras in Kharif and Rabi season

The natural weed community was composed of 23 and 19 different species during 2016-17 in Kharif and Rabi, respectively. However, during both seasons, dominant weed species were very similar (Table 1).

Yield component and yields of groundnut

Results of number of pods per plant, number of seeds per plant and seed index were shown in Table 3. Both weedy and weed free treatments are shows significant effect on yield components of groundnut. Increasing weed free periods increases the yield components. The highest number of pods per plant with 22.20, 16.52 and 18.80 in *Kharif, Rabi* and *Pooled* was found in weed free up to crop harvest in both season and lowest was in season long weedy treatment. Similarly, in *Kharif* the number of seeds per pod (1.90) and seed index (24.01) were highest in season long weed free treatment but the highest value of seeds pod^{-1} (1.80 and 1.85) and seed index (23.52 and 23.59) in *Rabi* and *Pooled*, respectively data shows in weeds until 15 DAE. However lowest value was found in season long weedy treatment of both season. Due to less competition within the plants, high light use efficiency, maximum leaf area and less weed pressure leads to reduced weed competition with allelopathic effect on crop in initial weed free treatments. The weeds interference duration increases with crop yield component and yield will reduce drastically. Either of situations i.e. weeds free for longer or weedy for shorter periods gave better groundnut yields in all seasons it corroborates with the findings of Bhalerao *et al.*, (2011) were reported that the maximum value of yield attributes, *viz.* total number of developed pods, hundred pod and hundred kernel, test weight, shelling percentage and volume weight) were observed in weed free treatment. Similarly, Olayinka and Etejere (2015) lowest yield components and yield were recorded in weedy check. Singh *et al.*, (2016) their results showed, that the yield attributes and grain yield declined with the increased duration of crop-weed interference period and increased with long weed free durations in spring maize. The results of seed yield, stover yield and harvest index were influences significantly. Further the Table 4 reviled that *Kharif* season getting maximum seed and stover yield and harvest index. In *Kharif, Rabi* and *Pooled* data highest value of seed yield (1.35, 0.94 and 1.15 t/ha), stover yield (3.87, 3.37 and 3.62 t/ha) and Harvest index (50.24, 21.84 and 23.86%) were found in season long weed free treatment and lowest was in season long weedy plot.

Increased weeds biomass accumulation with the increasing length of weed interference period might also be a probable source of yield reduction in groundnut. The results supported the opinion of Singh and Joshi (1993), where higher pod yield is attributed to better N accumulation, higher dry matter and CGR. Weed competition throughout the crop duration resulted in 100% yield loss in both rice cultivars compared to weed-free conditions, in which yield was 6.39-6.80 t/ha for cultivar PR 114 and 6.49-6.87 t/ha for PR 115 (Singh *et al.*, 2014). Mandal *et al.*, (2006) reported that weed free from 7 or 14 DAS shows significantly higher yield. On the contrary weed free after 28 DAS onwards did not increase the yield significantly over weedy check. Hamzei *et al.*, (2007) reported that different weed interference durations and interaction of cultivar year affected significantly the grain, oil, and biological yield, but not the percentage of oil. The highest harvest index was achieved in weed control up to 10 days after emergence in maize. In case of faba bean grain yield and yield contributing traits were significantly affected by weed competition. Weed-crop competition may end from 45 days. Grain yield losses due to uncontrolled weed growth throughout the crop cycle were 46%. At the same time, plant height, numbers of pods per plant, numbers of seeds per pod and 1000 seed weight were significantly decreased due to weeds (Kavurmaci *et al.*, 2010).

The highest growth, yield component and yield of groundnut were found in *Kharif* season

followed by *Rabi* season. Similarly, highest value were found in season long weed free treatment and lowest were found in season long weedy treatment. Generally the weeds were compete more at initial stage of crop growth because of initially crops grows slower in growth and weeds are taking advantage to utilise resources efficiently. Later stage of weeds are suppressed by crop due to smothering effect so early stage weed management is advisable for getting better yield of groundnut.

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