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Effect of weed management practices on yield, quality and economics of groundnut (*Arachis hypogaea* L.) during summer season

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Abstract

A field experiment was conducted at Agricultural Farm, Institute of Agriculture, Visva-Bharati, Sriniketan, West Bengal on sandy loam soil during pre- *kharif* season 2018 to study the effect of weed management practices on yield, quality and economics of summer groundnut (*Arachis hypogaea* L.). The experiment comprising of eight treatments was laid out in a randomized block design with three replications. Among the different herbicides, application of Flumioxazin 50% SL 125 g ha⁻¹ at 1 DAS resulted significantly higher pod yield (2991.02 kg ha⁻¹), haulm yield (2949.18 kg ha⁻¹), oil content (46.27%), gross return (₹143569 ha⁻¹), net return (₹109161 ha⁻¹) and benefit-cost ratio (3.22) over all other herbicidal treatments although weed free check was found most effective to control weeds in groundnut and recorded highest yield and gross return but lower the net return and benefit-cost ratio.

Keywords: Cucumber, boron, yield, quality, konkan

Introduction

Groundnut (*Arachis hypogaea* L.) is one of the most important oilseed and cash crop of India. It is also known as poor men's cashewnut and wonder nut. It is a low-priced commodity but a valuable source of all the nutrients. Groundnut is a rich source of protein (26%) and contains 45% oil, so it is one of the most important crops for producing edible oil. It encounters severe problem of weed infestation especially in the early stages of growth because the seedling emerges 7 to 10 days after sowing coupled with the slow growth in the initial stages. The presence of weeds as pest is more pernicious and serious because it can drastically reduce the growth of groundnut (Garko *et al.*, 2016) [4]. According to Ayomide (2010) [1], weed caused much damage to the groundnut crop during the first 45 days of its growth. Weeds may cause yield losses as high as 70% in groundnut (Devi Dayal, 2004; Jat *et al.*, 2011) [2, 6]. Weeds compete for water, nutrients, solar radiation, and underground space, and hinder pegging as well. 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. Besides, weeds when not controlled effectively lead to heavy pod loss during harvesting by intermingling with and breaking pods from plants. Early good weed control together with other agronomic practices if followed, promotes vigorous crop growth that can suppress subsequent weed growth (El Naim *et al.*, 2010) [3] especially crop cultivars with running growth habit. The presence of weeds for long time in the field reduces the size of pod and seed and hence the economic produce deteriorates in its quality and fetches lower price in the market (Devi Dayal, 2004) [2]. Now-a-days farmers are showing increasing interest in the use of herbicides for controlling weeds with the urge of reducing cost of cultivation owing to shortage of and high cost of labour (Savu *et al.*, 2005) [7]. Therefore, the present investigation was undertaken with the objective of finding suitability of different pre-emergence herbicides and their doses for groundnut, so that practically convenient and economically feasible strategy for weed management can be developed for the *summer* groundnut.

Materials and methods

A field experiment was conducted under red and lateritic soils of West Bengal during summer season, 2018 at the Agricultural Farm, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan, West-Bengal which is situated an altitude of 59.00 meter above mean sea level and lies at 23°.66'N latitude and 87°.66'E longitude. The total rainfall received during the crop season was 16.6 mm. The soil was sandy loam (72.60% sand, 17.80% silt and 9.60% clay) in texture and strongly acidic in reaction (pH 5.5) with electric conductivity 0.26 dS/m, low in organic carbon (0.42%), available N (240 kg/ha), available phosphorus (25.54 kg/ha) and available potassium (150.00 kg/ha). Eight treatment combinations viz., Flumioxazin 50% SL 75 g a.i ha⁻¹ at 1 DAS, Flumioxazin 50% SL 100 g a.i ha⁻¹ at 1 DAS, Flumioxazin 50% SL 125 g a.i ha⁻¹ at 1 DAS, Flumioxazin 50% SL 150 g a.i ha⁻¹ at 1 DAS, Imazethapyr 10% SL 100 g a.i ha⁻¹ at 1 DAS, Pendimethalin 30% EC 750 g a.i ha⁻¹ at 1 DAS, Untreated control and Weed free check were tested in a Randomized Block Design with three replications. The groundnut variety, Tag-24 was sown on 25th of February 2018 in row 30 cm apart using seed rate of 120 kg ha⁻¹ in a plot measuring 12 m². Seeds were treated with carbendazim to avoid the possible occurrence of the seed and soil borne diseases. The recommended dose of fertilizers (N: P₂O₅: K₂O-20: 40: 60 kg ha⁻¹ as Urea, SSP and MOP) applied as basal prior to sowing. Flumioxazin, Pendimethalin and Imazethapyr was applied next day of sowing as per treatment. The herbicide spraying was done with flat fan nozzle. Four irrigations were given during the crop growing period. Pod yield for each plant was obtained from the net plots and converted to ha⁻¹ pod yield. Aerial parts or haulm, after separation of pods were sun dried for seven days. Dry weight of this produce was taken as haulm yield. Yield of haulm per net plot was recorded and expressed on hectare basis. Oil content in kernel was determined by Soxhlet Extraction Method. The economics of different treatments were computed by considering the prevailing market price of inputs and produce of *summer* groundnut. The data were statistically analysed.

Result and discussion

Yield

Results showed that the effect of all weed management strategies significantly influenced the yield of groundnut over untreated control (Table 1). Among herbicidal treatment, Flumioxazin 50% SL 125 g a.i ha⁻¹ at 1 DAS resulted significantly higher pod and haulm yield over untreated control but was at par with Flumioxazin 50% SL 150 g a.i ha⁻¹ at 1 DAS. Significant lowest values of pod yield and haulm yield were recorded under untreated control treatment due to severe groundnut weed competition occurred throughout the growing period while highest values for those parameters were recorded under weed free treatment due to low crop-weed competition in critical period. Pod yield is an end product, which obviously depends upon the dry matter production of crop growth and its partitioning into reproductive parts. Therefore, increase in the dry matter of groundnut was attributed to the decreased weed population and lesser dry weight of weeds thus resulted in decreased competition by weeds to moisture, light and nutrients. The effect of which can be traced back to increased dry matter accumulation in stem, leaves and pods. Murthy *et al.* (1992)^[14] and Kumar and Sharma (1996)^[11] have reported significant reduction in the dry matter accumulation and lower pod yield in groundnut under weedy check. The dry matter

production and its accumulation in reproductive parts depends upon the photosynthetic ability of the plant and can be analysed through leaf area and dry matter accumulation in leaves, which in turn influence the photosynthetic ability, performance and yield of the crop. The results collaborate with the findings of Kumar and Sharma (1997)^[12] and Yadav *et al.* (2014)^[8]. Singh and Giri (2001)^[18] also concluded that proper weed control was responsible for increase in plant height and dry matter production in groundnut. It is fact that weed free environment in crop facilitated better peg initiation and development at the critical growth stages of groundnut which tends to increase in number of pods plant⁻¹ and pod yield ha⁻¹. Higher profitable pod yield of summer groundnut was also reported by Raj *et al.* (2008)^[15] with keeping the crop in weed free condition. The higher pod yield in Flumioxazin 50% SL 125 g a.i ha⁻¹ at 1 DAS or Flumioxazin 50% SL 150 g a.i ha⁻¹ at 1 DAS or its higher levels over untreated control treatment might be due to suppression of weed seed germination and seedling development at early stages due to pre-emergent herbicides. Exceptional weeds emerged were removed through effects of these herbicides hence treatments get weed free condition where in weed free check, weeds were removed as and when they emerged from soil. Untreated control gave reduced yield due to presence of weeds and resulted in increased weed competition for growth resources, especially for moisture, nutrients and light. Similar yield reduction due to presence of weeds has been reported by Hiremath *et al.* (1997)^[9] and Kori (2000)^[10].

Quality

Oil content in kernel were significantly influenced by different weed-management practices (Table 1). It was observed from the data that, weed free plot recorded maximum oil percentage (49.60%) over rest of the treatments. Among the herbicidal treatments oil percentage of Flumioxazin 50% SL 125 g ha⁻¹ was found to be higher which was at par with Flumioxazin 50% SL 150 g ha⁻¹. It might be due to effective weed control owing to these treatments led to higher nutrient uptake, and consequently higher oil content compared to untreated control.

Economics

All the weed management practices recorded higher net returns and B: C ratio over untreated control (Table 2). While, among all the treatments highest benefit-cost ratio was obtained with Flumioxazin 50% SL 125 g ha⁻¹. This was due to higher pod yield and subsequently lower cost of cultivation (Mene *et al.*, 2003)^[13] of groundnut crop which was increased in treatment weed free check due to the higher need of human labours and their higher wages. That's why gross return was found maximum with weed free check but benefit-cost ratio less than the applying different doses of Flumioxazin. Sasikala *et al.* (2004)^[17] and Rao *et al.* (2011)^[16] have also reported higher net return and B: C ratio with pre and post emergence application of herbicides. Untreated control recorded lower net returns and B: C ratio and it is quite important to note that keeping the land free of weeds throughout the crop growth period is practically impossible by the farmers, since involves huge cost on labour. Tewari *et al.* (1989)^[19] reported that the additional amount of income obtained under weed free appeared to be immaterial when compared to cost of weeding incurred to maintain weed free condition beyond eight weeks after sowing. The availability of working forces in villages has been reduced considerably and availability of required labour force at particular stage of crop growth is also difficult.

Conclusion

From the present investigation it can be concluded that all weed management practices are almost equally important in

improving crop yield but Flumioxazin 50% SL 125 g ha⁻¹ was superior most with respect to yield, quality and monetary returns.

Table 1: Effect of weed management practices on yield and quality of summer groundnut

Treatments	Pod yield (kg ha ⁻¹)	Haulm yield (kg ha ⁻¹)	Harvest index (%)	Oil content (%)
Flumioxazin 50% SL 75 g ha ⁻¹ at 1 DAS	2087.00	2544.12	45.02	44.14
Flumioxazin 50% SL 100 g ha ⁻¹ at 1 DAS	2576.00	2743.80	48.39	45.75
Flumioxazin 50% SL 125 g ha ⁻¹ at 1 DAS	2991.02	2949.18	50.35	46.27
Flumioxazin 50% SL 150 g ha ⁻¹ at 1 DAS	3199.33	3155.73	50.37	47.25
Imazethapyr 10% SL 100 g ha ⁻¹ at 1 DAS	2078.43	2746.97	42.69	43.50
Pendimethalin 30% EC 750 g ha ⁻¹ at 1 DAS	2033.00	2722.81	42.82	40.99
Untreated control	901.50	1890.04	32.57	38.43
Weed free check	3489.33	3509.54	49.85	49.60
S.Em(±)	100.15	122.98	1.93	2.05
CD at 5%	303.77	362.80	5.89	6.22
CV (%)	7.17	7.66	7.39	7.97

Table 2: Effect of weed management practices on economics of summer groundnut

Treatment	Cost of Cultivation (₹ ha ⁻¹)	Gross return (₹ ha ⁻¹)	Net return (₹ ha ⁻¹)	B: C Ratio
Flumioxazin 50% SL 75 g ha ⁻¹ at 1 DAS	34408	100176	65768	1.90
Flumioxazin 50% SL 100 g ha ⁻¹ at 1 DAS	34408	123648	89240	2.34
Flumioxazin 50% SL 125 g ha ⁻¹ at 1 DAS	34408	143569	109161	3.22
Flumioxazin 50% SL 150 g ha ⁻¹ at 1 DAS	34408	153568	119160	3.19
Imazethapyr 10 SL 100 g ha ⁻¹ at 1 DAS	34368	99765	65397	1.88
Pendimethalin 30% EC 750 g ha ⁻¹ at 1 DAS	34363	97584	63221	1.61
Untreated control	33388	43704	10316	0.19
Weed free check	51388	167488	116100	2.13
S.Em(±)	-	4807	4807	1.90
CD at 5%	-	14580	14580	2.34
CV (%)	-	7.17	10.43	3.22

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