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PERFORMANCE OF PLANT MATER EXTRACTS ON WEED GROWTH AND YIELD OF *RABI* GROUNDNUT

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ABSTRACT

A field experiment was conducted on sandy loam soils of S.V. Agricultural College Farm. Tinipati, during *rabi* 2017-18. to know the effect of different plant water extracts for weed management in *rabi* groundnut. The experiment was laid out in a randomized block design with ten treatments and replicated thrice. The treatments consisted of ten weed management practices *viz.,* six plant water extracts, one mulch treatment, two chemical weed management methods and an un weeded check. Weed growth and yield of *rabi* groundnut was significantly influenced by different weed management practices. Among the weed management practices, pre-emergence application of pendimethalin 1kg ha^{-1} supplemented with hand weeding at 30 DAS (W_8) recorded significantly lesser density and dry weight of weeds with higher weed control efficiency which inturn enhanced all the growth and yield components and yield of *rabi* groundnut. The lowest density and dry weight of all categories of weeds and highest increase in growth parameters *viz,* plant height, leaf area index, dry matter production and yield of groundnut were recorded with paddy straw mulch 5 t ha^{-1} (W_7) followed by sunflower water extract spray 15 1 ha^{-1} twice at 15 and 30 DAS (W_2). Among the organic weed management practices, all the plant water extracts were not effective as that of synthetic herbicides. The lowest values of growth parameters of *rabi* groundnut were computed with parthenium water extract spray 15 1 ha^{-1} twice at 15 and 30 DAS (W_4) which was at par with un weeded check (W_{10}). All the plant water extracts were not effective as that of synthetic herbicides.

INTRODUCTION

Groundnut ***(Arachls hypogaea* L.)** is known as poor man's cashew nut, wonder nut and an important oil seed crop around the world as well as in India. India has a diverse climate, as such groundnut is grown throughout the year in ***kharif, rabi*** and summer seasons in one or other parts of the country. Among the several factors limiting the productivity of groundnut, weeds are considered to be one of the major yield limiting factors. Though, groundnut is a hardy crop, it is highly susceptible to weed preponderance due to small canopy and slow initial growth. Generally weeds are controlled through hand weeding in groundnut, but it is expensive, laborious and continuous rains will interfere with timely mechanical weeding. Modernized methods of weed management is the need of the day through introduction of herbicides for effective weed control and to meet the labour shortage during the peak period of demand and increased cost of weeding (Annadurai ***et al.,*** 2010**).**

Weed control with herbicides is expensive practice and pose detrimental effect on the environment. The toxic herbicides are continuously polluting the surface and ground water for livestock as well as human beings while their residues released from plants as well as from soil move into the nutrition cycle and ultimately become perilous for descendants (Judith ***et al.,* 2001).** Weeds can be belter controlled by the utilization of plants that possess a greater fraction of allelochemicals (Elijarrat and Barcelo, **2001).** Allelopathy is one of the sources to identify suitable organic weed management practices. A number of secondary metabolites/allelomones produced by some of the plants act as potential natural herbicides with considerable crop selectivity, which could be directly used in the form of aqueous plant water extracts for weed management in organic and sustainable agriculture systems.

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MATERIAL AND METHODS

The field experiment was conducted at S.V. Agricultural College Wetland Farm, Tirupati during *rabi,* 2017-18. No rainfall was received during the crop growth period and the soil of the experimental field was sandy loam in texture, slightly alkaline in soil reaction (pH 7.7), low in organic carbon (0.23 %) and available N (128 kg ha"[1]) and medium in available phosphorus (12 kg ha*[1]) and available potassium (225 kg ha"[1]).

The field experiment was laid out in Randomized Block Design (RBD). There were ten treatments and three replications. The treatment details are furnished below.

W1: Sorghum water extract spray @ 15 1 ha^{-1} twice at 15 and 30 DAS.

W2: Sunflower water extract spray @ 15 1 ha^{-1} twice at 15 and 30 DAS.

W3: Rice straw water extract spray @15 1 ha^{-1} twice at 15 and 30 DAS.

W4: Parthenium water extract spray @15 1 ha"[1] twice at 15 and 30 DAS.

W5: Lantana water extract spray @ 15 1 ha"[1] twice at 15 and 30 DAS

W6: Purple nuts edge water extract spray @ 15 1 ha"[1] twice at 15 and 30 DAS.

W7: Paddy straw mulch @ 5 t ha^{-1}

W_8: Pre -emergence application of pendimethalin @ 1 kg *a.i.* ha"[1] + one Hand weeding at 30 DAS

W_9: Post-emergence application of imazethapyr @ 75 g *a.i.* ha"[1] at 20 DAS

W10**:** Un weeded check (Control)

Sorghum (NJ-2647) and sunflower (NDSH-1012) were raised during *kharif 2017 in* an area of 20 m^2 upto physiological maturity and then harvested. The harvested crops were dried under shade for 10 days and stored. Required quantity of rice straw of rice variety (NLR-34449) was brought from Regional Agricultural Research Station, Tirupati and used as paddy straw mulch as well as to prepare the rice straw water extract. Carrot grass *(Parthenium hysterophorus* L.), lantana *(Lantana camara* L.) and purple nutsedge *(Cyperus rotundus* L.) tubers were collected from the wet land farm, dried under shade conditions and stored at room temperature. The dried material of entire plant parts were chopped with power operated fodder chaff cutter into 2 cm pieces, separately. The chopped plant material was soaked in distilled water for 24 hours at room temperature of 21 °C at a ratio of 1:10 (w/v) and the same was filtered through 10 and 60 mesh sieve according to procedure laid down by Cheema *et al.* (2003). The extracts were applied twice at 15 DAS and 30 DAS each at 15 1 ha^{-1} on *rabi* groundnut raised during *rabi* 2017-18 and obsrvations were recorded on weed growth at 15, 30 & 60 DAS and at harvest (the crop was harvested on 22 April in 2018).

RESULTS AND DISCUSSION

Weed growth

At all the stages of observations *viz.,* 15, 30 & 60 DAS and at harvest, all the organic weed management practices recorded significantly lesser density and dry weight of all the categories of weeds compared to unweeded check, but significantly higher than with chemical weed management practices *i.e.* pre-emergence application of pendimethalin 1kg ha^{-1} supplemented with hand weeding at 30 DAS (W_8) and post-emergence application of imazethapyr 75 g ha^{-1} (W_9). These results are in agreement with those of Sagvekar *et al* (2015).

Among all the organic weed management practices investigated *i.e.* paddy straw mulch 5 t ha^{-1} (W_7) and plant water extracts, the lowest density and dry weight of weeds were recorded with paddy straw mulch 5 t ha^{-1}(W7). Paddy straw mulch might have increased the albedo and decreased the solar energy flux to the soil, which inturn reduce the germination and growth of weed. Sunflower water extract spray 15 1 ha^{-1} twice at 15 and 30 DAS (W_2) recorded significantly lesser density and dry weight of weeds. Among all the plant water extracts, the highest density and dry weight of weeds was recorded with parthenium water extract spray (W_4) followed by purple nutsedge water extract spray (W_6). This might bedue to ineffective allelopathic effects of these water extracts on weed growth.

The maximum weed control efficiency was recorded with pre-emergence application of pendimethalin 1kg ha^{-1} supplemented with hand weeding at 30 DAS (W_8) followed post-emergence application of imazethapyr 75 g ha^{-1} (W_9). At all the stages of observations, the lowest weed control efficiency was registered with parthenium water extract **(W4)** followed by purple nutsedge water extract spray *(W6)* as the plant water extracts spray twice at 15 and 30 DAS were unable to suppress the weed dry weight as that of sunflower water extract **(W2).**

Growth parameters and yield of *rabi* groundnut

The highest stature of groundnut plants were produced in plots applied with paddy straw mulch 5 t ha^{-1} **(W7),** which was significantly higher than with pre-emergence application of pendimethalin 1kg ha^{-1} supplemented with hand weeding at 30 DAS (W_8). This might be due to effective control of weeds, owing to reduced crop weed competition during the critical stages of crop growth, which inturn resulted in rapid cell multiplication and elongation, leading to increasing the internodal length. The next best treatment was the sunflower water extract spray **(W2)** which was statistically at par with sorghum water extract spray (W1) at 30 DAS and at harvest, but both were significantly differed at 60 DAS. Naeem *et al.* (2016) also reported increased plant height with sunflower extract. The lowest plant height was recorded with unweeded check (W10), which was significantly lesser than with rest of the weed management practices due to heavy weed infestation.

The highest leaf area index was computed with pre-emergence application of pendimethalin 1kg ha^{-1} supplemented with hand weeding at 30 DAS **(W8),** which was significantly higher than rest of the weed management practices. This might be due to maintainance of weed free environment, lead to better utilization of growth resources which might have increased the size and number of leaves. These results are in accordance with Ramakrishna *et al.* (2006). Spraying of sunflower water-extract spray **(W2)** recorded significantly higher leaf area index, which was statistically at par with sorghum water extract spray (Wi). Among the plant water extracts, the highest dry matter production was registered with sunflower water extarct spray which was statistically at par with sorghum water extract spray (W1). The increase in dry matter production in these plant water extracts might be due to better weed control, which helped groundnut to utilize the available resources more efficiently resulting in increased dry matter production.

Among the weed management practices tested, the highest pod yield of groundnut was recorded with pre-emergence application of pendimethalin 1kg ha^{-1} supplemented with hand weeding at 30 DAS (W8) which was significantly higher than the rest of the weed management practices due to increased stature of yield components *viz.,* number of filled pods $plant^{-1}$ and hundred pod weight as a result of less competition offered by weeds for growth resources. These results are in conformity with those of Ramakrishna *et al.* (2006). Among the organic weed management practices, paddy straw mulch 5 t ha^{-1} (W_7) produced significantly higher pod yield. These results are in conformity with those of Ramakrishna *et al.* (2006) and Shahawy *et al.* (2006). Among the plant water extracts, the highest pod yield was obtained with sunflower water extract spray (W2) which was at par with sorghum water extract spray **(W1)** than rest of the organic weed management practices. Similar results were also reported by Naeem *et al.* (2016) . The lowest pod yield was obtained from unweeded check **(W10)** plots due to reduced yield components because of poor translocation of photosynthates from source to developing pods. The reduction in pod yield of groundnut due to unchecked weed growth was 52.53, 37.18 and 38.84 per cent compared to pre-emergence application of pendimethalin 1kg ha^{-1} supplemented with hand weeding at 30 DAS (W8), paddy straw mulch 5 t ha^{-1} (W7) and sunflower water extract spray **(W2),** respectively.

CONCLUSION

In the present study, higher yields were obtained with pre-emergence application of pendimethalin 1kg ha^{-1} supplemented with hand weeding at 30 DAS (W8). However, among the organic treatments, application of paddy straw mulch 5 t ha^{-1} **(W7)** was found to be the best followed by sunflower water extract spray 15 l ha^{-1} twice at 15 and 30 DAS wherein these treatments recorded significantly higher pod yield. Thus, in view of sustainability and to reduce herbicide load in the soil, weed management with plant water extracts could be considered as a worthwhile alternative.

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Table 1. Weed density, weed dry weight and weed control efficiency of *rabi* groundnut as influenced by different weed management!

Treatments	Weed density (no. m^{-2})	Weed dry weight (g m^{-2})	Weed control efficiency (%)
W_1: Sorghum water extract spray @ 15 I ha^{-1} twice at 15 and 30 DAS	95.66 (9.83)	66.52 (8.22)	57.35
W_2: Sunflower water extract spray @ 15 1 ha^{-1} twice at 15 and 30 DAS	77.00 (8.80)	62.35 (7.92)	61.58
W_3: Rice straw water extract spray @15 1 ha^{-1} twice at 15 and 30 DAS	114.00 (10.70)	76.86 (8.79)	52.56
W_4: Parthenium water extract spray @15 1 ha^{-1} twice at 15 and 30 DAS	129.66 (11.43)	86.47 (9.33)	46.63
W_5: Lantana water extract spray @ 15 l ha^{-1} twice at 15 and 30 DAS	105.33 (10.31)	69.74 (8.38)	56.96
W_6: Purple nutsedge water extract spray @ 15 1 ha^{-1} twice at 15 and 30 DAS	124.33 (11.20)	84.16 (9.20)	48.05
W_7: Paddy straw mulch @ 5 t ha^{-1}	62.33 (7.93)	38.33 (6.23)	76.34
W_8: Pre-emergence application of pendimethalin @ 1 kg ***a.i.*** ha^{-1} + one HW at 30 DAS	39.67 (6.34)	26.9 (5.23)	83.39
W_9: Post-emergence application of imazcthapyr @ 75 g ***a.i.*** ha^{-1} at 20 DAS	49.00 (7.04)	42.27 (6.55)	73.84
W_{10}: Unweedcd check (Control)	301.34 (17.37)	162.02 (12.75)	-
SEm±	0.28	0.10	
CD (P = 0.05)	0.85	0.31	

Figures in parenthesis indicates square root transformed (vx+0.5) values

Table 2. Growth parameters and pod yield of *rabi* groundnut as influenced by weed management practices

Treatments	Plant height (cm)	Leaf area index	Dry matter Production (kg ha^{-1})	Pod yield (kg ha^{-1})
W_1: Sorghum water extract spray @ 15 I ha^{-1} twice at 15 and 30 DAS	25.35	1.21	5172	1846
W_2: Sunflower water extract spray @ 15 1 ha^{-1} twice at 15 and 30 DAS	25.95	1.23	5220	1903
W_3: Rice straw water extract spray @15 1 ha^{-1} twice at 15 and 30 DAS	23.96	LIS	5075	1614
W_4: Parthenium water extract spray @15 1 ha^{-1} twice at 15 and 30 DAS	24.48	1.07	4658	1395
W_5: Lantana water extract spray @ 15 l ha^{-1} twice at 15 and 30 DAS	24.95	1.17	5050	1716
W_6: Purple nutsedge water extract spray @ 15 1 ha^{-1} twice at 15 and 30 DAS	24.43	1.11	4928	1419
W_7: Paddy straw mulch @ 5 t ha^{-1}	33.76	1.25	5340	2095
W_8: Pre-emergence application of pendimethalin @ 1 kg ***a.i.*** ha^{-1} + one HW at 30 DAS	30.56	1.37	5644	2772
W_9: Post-emergence application of imazcthapyr @ 75 g ***a.i.*** ha^{-1} at 20 DAS	29.47	1.24	5396	2554
W_{10}: Unweedcd check (Control)	19.06	1.02	4084	1316
SEm±	0.36	0.02	42	53
CD (P = 0.05)	1.07	0.06	126	157