Impact of weedicides on chlorophyll content at different growth stages in *rabi* groundnut (*Arachis hypogaea* L.)

Nivetha C*[1], Paulpandi V K[2], Durai Singh R [3], Kumutha K[4], Kannan P[5]

[1]Ph.D Scholar, Department of Agronomy, [2] Professor, Department of Agronomy,
[3] Professor and Head, Department of Agronomy,
[4] Professor and Head, Department of Agricultural Microbiology,
[5] Assistant Professor, Department of Soil Science and Agricultural Chemistry,
Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai.

*** Corresponding author mail id : cnivetha000@gmail.com**

Abstract

Field experiment was conducted during January to May, rabi, 2022 on red sandy loam soil to find out efficient method of weed control in groundnut at Devankottai village, Sivagangai district of Tamil Nadu, India. Results indicated that, weed free check recorded highest chlorophyll at different growth stages of groundnut and followed by hand weeding twice under cultural practices. Among the herbicidal treatment pre emergence application of Pendimethalin + Imazethapyr (ready mix) integrated with hand weeding on 40 DAS was obtained highest chlorophyll content and the least chlorophyll content was recorded by unweeded check.

Keywords : Groundnut, herbicides, hand weeding, SPAD chlorophyll content

Introduction

Groundnut (*Arachis hypogea* L.) is one of the most significant oilseed crops , which is grown for its edible oil, protein, and confectionary uses. Because groundnut is very sensitive to weed infestation due to its slow growth rate at initial stage and its physiological traits like small plant stature and underground pod bearing behaviour. *Rabi* groundnut cultivation needs frequent weed control measures for greater seed yield. Groundnut yield is reduced by 54 to 71% by uncontrolled weeds, especially in the early stages of crop growth (Agasimani *et al*., 2010). Compared to other crops, weeds have trouble pegging, growing, developing pod, and harvesting in groundnut. They also compete with crops for resources like nutrients, sunlight, water, and air. It was observed that the crucial time for weed competition was 4 to 8 weeks after sowing (Hamada, 1988). Weeding needs to be done prior to the groundnut pegging phase. Currently, manual weeding is more expensive and drives up production costs.

Under rabi conditions, the most potent weedicide is needed in order to prevent such an experience. In order to boost agricultural productivity by reducing weed competition with crops, herbicides are widely used around the world. A shortfall of agricultural laborers who move from rural to urban regions as a result of industrialization is one cause for the usage of

herbicides in crop farming (Hossain, 2015). Practically, using herbicides to manage weeds is more effective since they may get to weeds that are resistant to conventional weed control methods (Rashid *et al*., 2012). Thus, this experiment was planned to know the feasibility of weedicides in groundnut integrated with manual weeding methods under *rabi* condition.

Materials and Methods

The field experiment was conducted on sandy soil of Devankottai village, Sivagangai district of Tamil Nadu during *rabi* season of 2022. The total rainfall received during crop growth season 23.48 mm with 16 rainy days. Total twelve treatments consisted of various combinations viz., pre emergence herbicides like Pendimathalin @ 3.3 l ha^{-1} , Oxyflourfen @ 250 g ha^{-1} and Pendimethalin 30% + Imazethapyr 2% EC (ready mix) @ 1.0 kg a.i ha^{-1} with one hand weeding and Post emergence herbicides namely Quizalofop ethyl 7.5% + Imazethapyr 15% EC (ready mix) @ 437.5 ml ha^{-1} and POE Imazethapyr @ 750 ml ha^{-1} and one treatment comprising only cultural practices like hand weeding at 20 and 40 DAS, one treatment as Unweeded check and one treatment as Weed free check was laid out in randomized block design and replicated thrice. Groundnut variety TMV 14 was sown on 22nd January 2022 at spacing of 30X10 cm using a seed rate of 125 kg ha^{-1}. Herbicides were applied by using a knapsack sprayer fitted with flat fan nozzle type calibrated to deliver 500 litres of water per hectare. All other cultural practices were done by recommended package of practices for groundnut.

The soil of the experimental field was red sandy loam in texture. Initial soil samples drawn from the experimental field was analyzed for various physical and chemical properties and the data are furnished in Table 1.

Table 1. Initial soil properties of the experimental field

Sl.No	Constituents	Content (%)	Methods employed	Authors
Mechanical analysis				
1	Clay (%)	22	International pipette method	Piper (1966)
2	Silt (%)	8		
3	Sand (%)	70		
4	Texture	Sandy loam		
Chemical analysis				
1	pH	6.58	1:2.5 soil: water suspension	Jackson (1973)
2	EC (dSm^{-1})	0.18	1:2.5 soil: water	

			suspension	Jackson (1973)
3	Organic carbon (%)	0.50	Chromic acid wet digestion method	Walkley and Black (1934)
4	Available N (kg ha^{-1})	182	Alkaline permanganate method	Subbiah and Asija (1956)
5	Available P (kg ha^{-1})	17.5	Olsen method	Olsen (1954)
6	Available K (kg ha^{-1})	221	Neutral normal ammonium acetate method	Standford and English (1949)

Chlorophyll content

Chlorophyll content of leaves was recorded as described by Peng *et al.,* (1993) using the chlorophyll meter (SPAD-502, Soil Plant analysis Development Section, Minolta Camera Co. Ltd., Japan). The readings were recorded on the upper most fully expanded leaves in five randomly chosen plants at 25, 50 and 75 DAS. The average values were worked out and expressed as SPAD readings.

Results and Discussion

Chlorophyll content (SPAD meter reading)

Chlorophyll content at 25, 50 and 75 days after sowing differed significantly due to weed management practices (Table 2). The highest chlorophyll content at 25 days after sowing were obtained in pre emergence application of Pendimethalin 30% + Imazethapyr 2% EC (ready mix) @ 1.0 kg *a.i* ha^{-1} integrated with Hand weeding on 40 DAS (30.85) and it was on par with weed free check (30.45). This might be due to lower weed competition during critical period of the crop growth stages, which might have provided better availability of soil moisture and nutrients for crop growth (Kowser *et al*., 2018). The lowest value was obtained by unweeded check (24.47).

At 50 DAS, weed free check recorded highest chlorophyll content (35.07) and it was on par with pre emergence application of Pendimethalin 30% + Imazethapyr 2% EC (ready mix) @ 1.0 kg *a.i* ha^{-1} integrated with Hand weeding on 40 DAS (33.04) and least chlorophyll content was obtained in unweeded check (26.63). As suggested by Wesley *et al*. (2008) the use of herbicides and hand weeding significantly improved the growth components when compared to an unweeded control, because less weed growth and density allowed more space, light, and nutrients for groundnut root growth, nodulation, and the best extension of leaves and branches. Weed free check recorded highest chlorophyll content (41.06) and it was on par with pre emergence application of Pendimethalin 30% + Imazethapyr 2% EC (ready mix) @ 1.0 kg *a.i* ha^{-1} integrated with Hand weeding on 40 DAS (38.57) and least chlorophyll content was obtained in unweeded check (30.56) at 75 DAS in groundnut (Fig 1).

Conclusion

Based on the results, it concluded that, weed free check (T_{12}) and Pre emergence application of Pendimethalin 30% + Imazethapyr 2% EC (ready mix) @ 1.0 kg *a.i* ha^{-1} followed by hand weeding on 40 DAS (T_7) given better results in cholorophyll content at different growth stages of groundnut. Due to labour shortages, a better alternative suggestion for controlling weeds is chemical control, which is more affordable, readily available, and effective when combined with one-handed weeding.

Conflict of interests

The authors declare that there is no competing interest.

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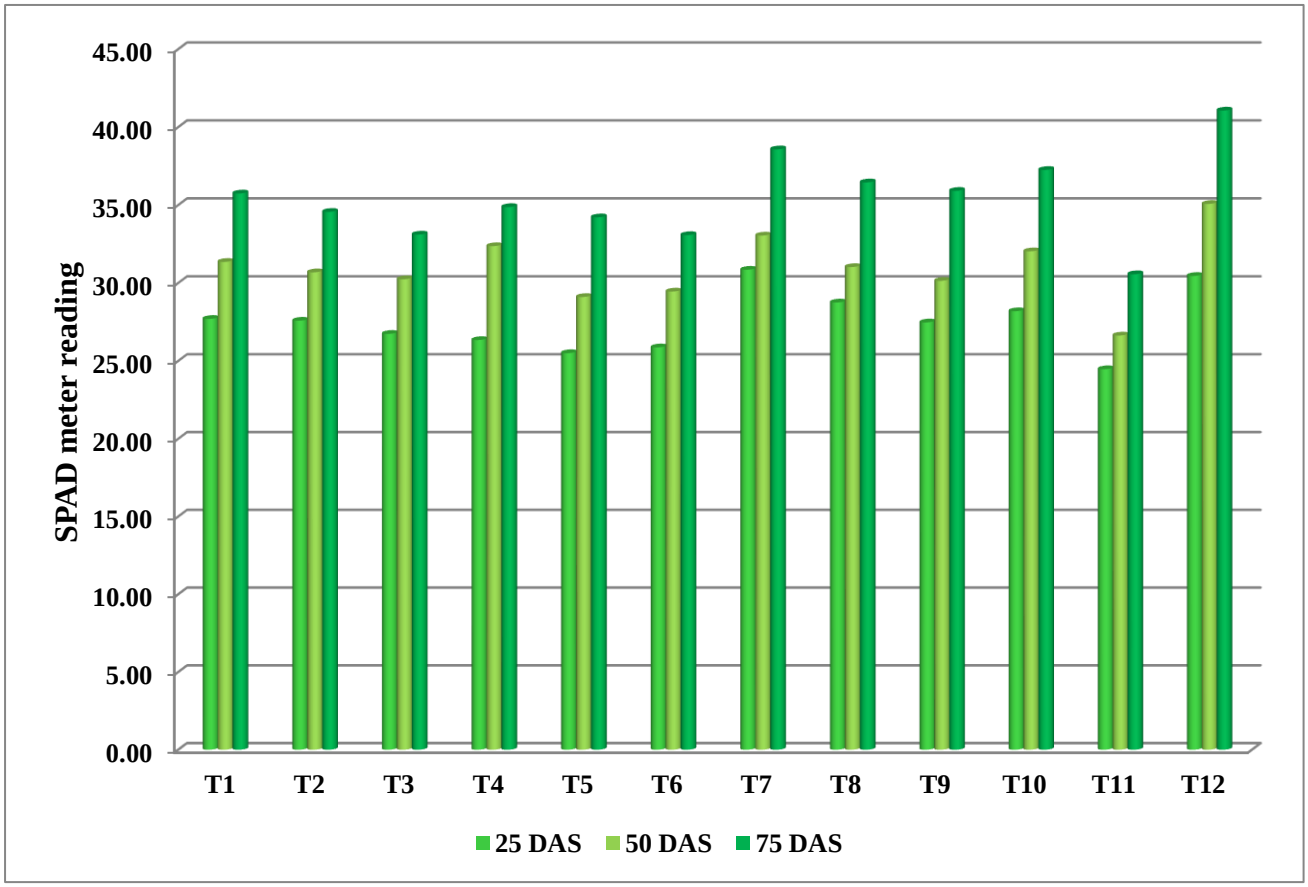

Fig 1. SPAD Chlorophyll meter reading at different growth stages of groundnut

Table 2. Impact of weedicide treatments on SPAD Chlorophyll meter reading

	Treatments	25 DAS	50 DAS	75 DAS
T_1	PDN @ 3.3 l ha^{-1} *fb* HW on 40 DAS	27.69	31.35	35.74
T_2	PDN @ 3.3 l ha^{-1} *fb* QUIZ 7.5% + IMAZ 15% EC (ready mix) @ 437.5 ml ha^{-1}	27.58	30.68	34.56
T_3	PDN @ 3.3 l ha^{-1} *fb* IMAZ @ 750 ml ha^{-1}	26.73	30.24	33.10
T_4	Oxyflourfen @ 250 g ha^{-1} *fb* HW on 40 DAS	26.34	32.36	34.87
T_5	Oxyflourfen @ 250 g ha^{-1} *fb* QUIZ 7.5% + IMAZ 15% EC (ready mix) @ 437.5 ml ha^{-1}	25.50	29.10	34.21
T_6	Oxyflourfen @ 250 g ha^{-1} *fb* IMAZ @ 750 ml ha^{-1}	25.87	29.45	33.07
T_7	PDN 30% + IMAZ 2% EC (ready mix) @ 1.0 kg *a.i* ha^{-1} *fb* HW on 40 DAS	30.85	33.04	38.57
T_8	PDN 30% + IMAZ 2% EC (ready mix) @ 1.0 kg *a.i* ha^{-1} *fb* QUIZ 7.5% + IMAZ 15% EC (ready mix) @ 437.5 ml ha^{-1}	28.75	31.02	36.45
T_9	PDN 30% + IMAZ 2% EC (ready mix) @ 1.0 kg *a.i* ha^{-1} *fb* IMAZ @ 750 ml ha^{-1}	27.47	30.14	35.91
T_{10}	HW at 20 and 40 DAS	28.19	32.03	37.25
T_{11}	Unweeded check	24.47	26.63	30.56
T_{12}	Weed free check	30.45	35.07	41.06
	SEd	0.78	1.02	1.21
	CD (P = 0.05)	1.61	2.11	2.50

fb – followed by DAS – Days After Sowing HW-Hand weeding
PDN- Pendimethalin IMAZ- Imazethapyr QUIZ – Quizalofop ethyl

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