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EFFECT OF HERBICIDAL WEED MANAGEMENT ON GROWTH ATTRIBUTES OF GROUNDNUT

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ABSTRACT

A field study was carried out to study the relative efficacy of herbicides on weed control in groundnut as well as to study its effect on growth of groundnut during *Kharif* season of 2022 and 2023 at All India Co-ordinated Research Project on Weed Management, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The experiment was laid out in Randomized Block Design with three replication and eight treatments. The treatments comprised of diclosulam 84% WDG at 0.026 kg/ha (PE) *fb* IC + HW at 40 DAS (T_1), diclosulam 84% WDG at 0.026 kg/ha (PE) *fb* fluazifop-p-butyl 11.1% w/w + fomesafen 11.1% w/w SL at 0.250 kg/ha PoE (2-3 leaf stage of weed) (T_2), diclosulam 84% WDG at 0.026 kg/ha (PE) *fb* quizalofop-ethyl 7.5% + imazethapyr 15% at 0.098 kg/ha PoE (2-3 leaf stage of weed) (T_3), diclosulam 84% WDG at 0.026 kg/ha (PE) *fb* propaquizafop 2.5% + imazethapyr 3.75% at 0.125 kg/ha PoE (2-3 leaf stage of weed) (T_4), pendimethalin + imazethapyr (RM) 0.8 kg/ha (PE) *fb* IC + HW at 40 DAS (T_5), sodium acifluorfen 16.5%+ clodinafop propargyl 8% EC at 0.245 kg/ha (RM) PoE (2-3 leaf stage of weed) *fb* IC + HW at 40 DAS (T_6), IC *fb* HW at 20 and 40 DAS (T_7) and Weedy check (T_8), respectively. Among the herbicidal treatments, application of Pendimethalin 30%+ Imazethapyr 2% EC @ 0.8 kg/ha (RM) pre-emergence *fb* Inter cultivation *fb* Hand weeding at 40 DAS produced higher plant height, dry matter accumulation, number of pinnate leaves, leaf area and total number of root nudules.

Key words : Herbicidal weed management, Groundnut, Growth attributes.

Introduction

Groundnut or peanut (*Arachis hypogaea* L.) is known as the “king” of oilseeds. Groundnut is also called as wonder nut and poor men’s cashew nut (Sathya Priya *et al*., 2013). It is known to be a unique and important legume cum oilseed crop of India accounting 18.96% of world’s groundnut area and about 14.05% of production (Anonymous, 2024). With annual all-season coverage of 48.80 lakh hectares, India ranks first in groundnut acreage globally and is the second largest producer of groundnut in the world with 102.89 lakh tonnes with a productivity of 1847 kg per hectare in 2023-24 (Anonymous, 2023-24). Nutritionally and commercially, it is a very important crop which contains 45 to 51% high quality hydrogenated edible oil and 25 to 28% dietary proteins, 24.2% soluble carbohydrates and minerals. In Maharashtra, the total area under groundnut was 2.26 lakh hectares, production was 2.84 lakh tonnes with productivity of 1257 kg/ha. In Vidarbha the total area under groundnut was 32.94 thousand hectares with production of 58.47 thousand tonnes and productivity of 1775 kg/ha (Anonymous, 2023-24).

By and large, one of the reasons for India’s large edible oil deficit is the poor yield of oilseed crops per hectare, principally caused by the biotic and abiotic stresses as well as poor farm practices. About 85% of the total groundnut in India is sown in the *kharif* season under rainfed conditions. In groundnut cultivation and particularly in *kharif* season, weeds are one of the important factors responsible for low yield. Warm and humid weather prevailing during its cultivation period affords repeated flushes of grasses and broadleaf weeds

through its entire growing season. Competitional stress of weeds causes reduction in pod yield to the extent of 17–84% (Wesley *et al*., 2008; Nambi and Sundari, 2008). In addition to competing with the crop, weeds in groundnut hinder its pegging, compete for underground space and make crop harvest cumbersome. During initial period of crop growth there is relatively shallow canopy and it slowly shades the inter-row area, this invites the weeds to emerge and establish and compete for available resources and thus groundnut crop becomes more susceptible to weed crop competition in the earlier growth period of the crop. Therefore, according to Wesley *et al*. (2008) the critical period of grass weed control was found to be from four to nine weeks after planting whereas, the critical period of broad-leaved weeds control was from two to eight weeks.

Area under groundnut crop has decreased considerably in the recent decades. According to Walia *et al.* (2007), there is an urgent need to explore the possibilities for increasing the productivity through better understanding of the constraints in production of oilseed crops especially in groundnut being one of the major edible oilseed crops. Weed menace being one of the serious bottlenecks in groundnut production, losses caused by weeds are more than any other causes like insects, diseases and nematodes (Chaitanya *et al*., 2012). Thus, proper weed management is essential to get optimum yield.

Physical and mechanical methods are effective in controlling irrespective of weeds and through loosening the soil also improve aeration, porosity, soil moisture conservation and ease of peg penetration in soil. But these methods are time and labour consuming and moreover with the increasing labour scarcity, it is difficult to manage weeds timely. Chemical weed management solely through pre- or post-emergent herbicide application gives a good result but cannot control a broad spectrum of weeds. Sequential application of pre and post emergence herbicides or integration of pre or post emergence herbicide with manual weeding may provide broad-spectrum weed control. Nowadays, there are new pre and post emergence herbicides and its ready-mix combinations for controlling broad spectrum weeds.

Success of crop depends largely on effective weed control under weed management strategy, however, manual weed control though effective but is costly and labour intensive. Chemical weed control is an alternative method that may be less expensive, but more risky because of weed becoming herbicide resistant and because of concerns about unwanted side effective of herbicides. In situations where timely weeding is not feasible due to paucity and high cost of labour or unfavorable soil conditions, chemical weed control through pre or post emergence herbicides may be preferred along with cultural practices for better weed management across the crop growth period. Use of pre and post-emergence herbicide mixtures offer an alternative viable option for effective and timely control of weeds. But each herbicide has its own spectrum of weed control (Kumar *et al*., 2019). Secondly, the timing of herbicide application also has much concern on weed control efficiency. The advantage of post emergence herbicide application is that the treatment can be ascertained after assessing degree of weed infestation and type of weed flora. The present study with weed control practices comprising new formulations and herbicide mixtures with varied application time and with integrated cultivation is a further step in the weed management strategy of groundnut crop.

Materials and Methods

The experiment was conducted at All India Co-ordinated Research Project on Weed Management, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The experimental site is situated in the subtropical zone at latitude 20.42°N and longitude 77.01°E. The altitude of the place is 307.41 meters above mean sea level. The climate of Akola is semi-arid and characterized by three distinct seasons viz., summer being hot and dry from March to May, warm and humid monsoon from June to October and winter with mild cold from November to February. Most of the rainfall received from south-west monsoon during June to October with mean annual normal precipitation of 741.8 mm in 40 rainy days.

Randomised block design was used in the trial with three replication and eight treatments. The treatments comprised of diclosulam 84% WDG at 0.026 kg/ha (PE) *fb* IC + HW at 40 DAS (T_1), diclosulam 84% WDG at 0.026 kg/ha (PE) *fb* fluazifop-p-butyl 11.1% w/w + fomesafen 11.1% w/w SL at 0.250 kg/ha PoE (2-3 leaf stage of weed) (T_2), diclosulam 84% WDG at 0.026 kg/ha (PE) *fb* quizalofop-ethyl 7.5% + imazethapyr 15% at 0.098 kg/ha PoE (2-3 leaf stage of weed) (T_3), diclosulam 84% WDG at 0.026 kg/ha (PE) *fb* propaquizafop 2.5% + imazethapyr 3.75% at 0.125 kg/ha PoE (2-3 leaf stage of weed) (T_4), pendimethalin + imazethapyr (RM) 0.8 kg/ha (PE) *fb* IC + HW at 40 DAS (T_5), sodium acifluorfen 16.5%+ clodinafop propargyl 8% EC at 0.245 kg/ha (RM) PoE (2-3 leaf stage of weed) *fb* IC + HW at 40 DAS (T_6), IC *fb* HW at 20 and 40 DAS (T_7) and Weedy check (T_8), respectively. The gross plot size was

5.50 m × 9.00 m, the net plot size was 4.60 m × 8.80 m. Groundnut (*TAG 73*) was sown on BBF at 45 × 10 cm spacing with 25:50:30 NPK kg/ha and gypsum @ 300 kg/ha.

Soil was analysed for testing its physical and chemical properties. After analysis it was observed that the textural class of the soil was Clayey in nature with 57.08 per cent clay. Available N, P and K content of the soil was 182, 17.3 and 264 kg ha^{-1}, while pH, EC and organic carbon content of the soil was 7.9, 0.24 dSm^{-1} and 0.46%, respectively. Pre emergence herbicides were applied the very next day of sowing and post emergence herbicides at 2-3 leaf stage of weeds.

Results and Discussion

Plant height

Plant height at harvest was influenced significantly due to various weed control treatments. It varied between 20.18 and 29.27 for year 2022 and between 20.94 to 32.11 for year 2023. Maximum plant height was recorded in treatment IC *fb* HW at 20 and 40 DAS (T_7) and pendimethalin 30% + imazethapyr 2% EC @ 0.8 kg/ha (RM) PE *fb* IC + HW at 40 DAS (T_5) this might be due to the least crop-weed competition. However, the minimum plant height was noticed in weedy check (T_8) which might be due to the competition between crop and weeds for soil moisture, plant nutrients, solar radiation and space during active growth period. These results are in accordance with the results reported by Ahmed *et al.* (2011) and Geetha Devi *et al.* (2017).

Number of functional pinnate leaves per plant

The effect of different weed control treatments was found to be statistically significant on number of functional pinnate leaves $plant^{-1}$. It varied from 14.55 to 25.29 during year 2022 and 15.09 to 23.24 during year 2023. The highest number of functional pinnate leaves $plant^{-1}$ were recorded in treatment IC *fb* HW at 20 and 40 DAS (T_7). While among herbicidal treatments highest number of functional pinnate leaves $plant^{-1}$ were recorded in treatment pendimethalin 30%+ imazethapyr 2% EC @ 0.8 kg/ha (RM) PE *fb* IC + HW at 40 DAS (T_5). The lowest was recorded in weedy check (T_8). This might be attributed to more competition for light, nutrients and space in the weedy check. Due to less crop weed competition in weed free check, application of post emergence and readily mix post emergence herbicide might have resulted in broad spectrum weed control during crop weed competition period and there by less competition for light, nutrient, moisture and space in the weed free environment

Table 1 : Plant height (cm) and number of functional pinnate leaves $plant^{-1}$ of groundnut as influenced by different weed control treatments during 2022-23 and 2023-24.

Treatments	Plant height (cm)		Number of functional pinnate leaves $plant^{-1}$	
	2022	2023	2022	2023
T_1 Diclosulam 84% WDG @ 0.026 kg/ha PE *fb* IC + HW at 40 DAS	26.85	30.04	23.81	20.38
T_2 Diclosulam 84% WDG @ 0.026 kg/ha PE *fb* fluazifop-p-butyl 11.1% w/w + fomesafen 11.1% SL @ 0.250 kg/ha (RM) PoE (2-3 leaf stage of weed)	23.80	23.70	18.33	17.02
T_3 Diclosulam 84% WDG @ 0.026 kg/ha PE *fb* quizalofop-ethyl 7.5% + imazethapyr 15% EC @ 0.098 kg/ha (RM) PoE (2-3 leaf stage of weed)	24.60	25.82	20.50	18.58
T_4 Diclosulam 84% WDG @ 0.026 kg/ha PE *fb* propaquizafop 2.5% + imazethapyr 3.75% ME @ 0.125 kg/ha (RM) PoE (2-3 leaf stage of weed)	24.70	26.96	21.56	19.48
T_5 Pendimethalin 30% + Imazethapyr 2% EC @ 0.8 kg/ha (RM) PE *fb* IC + HW at 40 DAS	27.50	31.24	24.18	21.54
T_6 Sodium acifluorfen 16.5%+ Clodinafop propargyl 8% EC @ 0.245 kg/ha (RM) PoE (2-3 leaf stage of weed) *fb* IC + HW at 40 DAS	23.70	25.15	17.90	18.40
T_7 IC *fb* HW at 20 and 40 DAS	29.57	32.11	25.29	23.24
T_8 Weedy check	20.18	20.94	14.55	15.09
S.E(m)±	1.08	1.64	0.49	1.18
C.D. at 5%	3.28	4.97	1.49	3.57
G.M.	25.09	26.99	20.76	19.22

Table 2 : Leaf area plant^{-1} (dm^2) and Dry matter accumulation plant^{-1} (g) of groundnut as influenced by different weed control treatments during 2022-23 and 2023-24.

Treatments	Leaf area plant^{-1} (dm^2)		Dry matter accumulation plant^{-1} (g)	
	2022	2023	2022	2023
T_1 Diclosulam 84% WDG @ 0.026 kg/ha PE *fb* IC + HW at 40 DAS	1.74	1.53	18.79	18.79
T_2 Diclosulam 84% WDG @ 0.026 kg/ha PE *fb* fluazifop-p-butyl 11.1% w/w + fomesafen 11.1% SL @ 0.250 kg/ha (RM) PoE (2-3 leaf stage of weed)	1.21	1.17	16.52	14.47
T_3 Diclosulam 84% WDG @ 0.026 kg/ha PE *fb* quizalofop-ethyl 7.5% + imazethapyr 15% EC @ 0.098 kg/ha (RM) PoE (2-3 leaf stage of weed)	1.36	1.27	17.29	17.08
T_4 Diclosulam 84% WDG @ 0.026 kg/ha PE *fb* propaquizafop 2.5% + imazethapyr 3.75% ME @ 0.125 kg/ha (RM) PoE (2-3 leaf stage of weed)	1.41	1.33	17.59	17.77
T_5 Pendimethalin 30%+ Imazethapyr 2% EC @ 0.8 kg/ha (RM) PE *fb* IC + HW at 40 DAS	1.81	1.56	19.48	19.86
T_6 Sodium acifluorfen 16.5%+ Clodinafop propargyl 8% EC @ 0.245 kg/ha (RM) PoE (2-3 leaf stage of weed) *fb* IC + HW at 40 DAS	1.12	1.24	16.30	16.38
T_7 IC *fb* HW at 20 and 40 DAS	1.89	1.72	19.79	21.47
T_8 Weedy check	0.84	0.88	10.54	11.94
S.E(m)±	0.08	0.07	0.34	1.10
C.D. at 5%	0.23	0.22	1.02	3.31
G.M.	1.42	1.34	17.03	17.22

leading to better growth of the plants in terms of number of leaves plant. These results are in conformity with those reported by Chaudhari (2007) and Kumar *et al*. (2007).

Leaf area plant^{-1}

The effect of various weed control treatments was found significant on Leaf area plant^{-1}. It varies from 0.84 to 1.89 for year 2022 and from 0.88 to 1.72 for year 2023. The treatment IC *fb* HW at 20 and 40 DAS (T_7) and pendimethalin 30%+ imazethapyr 2% EC @ 0.8 kg/ha (RM) PE *fb* IC + HW at 40 DAS (T_5) recorded highest leaf area plant^{-1} which might be due to the fact that under low weed density crop have access to more available resources, such as sunlight, nutrients and water. This reduced competition allows the crop plants to allocate more resources towards leaf growth. And the lowest leaf area plant^{-1} was recorded in weedy check. These results are in conformity with the findings of Chaudhari (2007) and Kumar *et al.* (2007).

Dry matter accumulation plant^{-1}

Dry matter accumulation plant^{-1} was affected significantly due to different weed management practices. Higher dry matter accumulation plant^{-1} of groundnut was noted in treatments IC *fb* HW at 20 and 40 DAS (T_7) and pendimethalin 30%+ imazethapyr 2% EC @ 0.8 kg/ha (RM) PE *fb* IC + HW at 40 DAS (T_5) and the lowest in weedy check. This was attributed to the decreased weed population and lesser dry weight of weeds resulting in decreased weed competition for moisture, light, space and nutrients. The results of this study are confirmed with the earlier findings of Geetha Devi *et al.* (2017) and Mehriya *et al.* (2021).

Total number of root nodules plant^{-1}

Total number of root nodules plant^{-1} were recorded at 20 and 40 DAS. At 20 DAS, it was found to be non-significant. While at 40 DAS it was found to be affected significantly due to various weed management treatments. Treatment IC fb HW at 20 and 40 DAS (T_7) noted maximum number of root nodules which was found statistically at par with treatment pendimethalin 30%+ imazethapyr 2% EC @ 0.8 kg/ha (RM) PE fb IC + HW at 40 DAS (T_5), diclosulam 84% WDG @ 0.026 kg/ha PE fb IC + HW at 40 DAS (T_1) and diclosulam 84% WDG @ 0.026 kg/ha (PE) fb propaquizafop 2.5% + imazethapyr 3.75% ME @ 0.125 kg/ha PoE (RM) (2-3 leaf stage of weed) (T_4).

The significant enhancement of root nodules in various weed management practices when compared to the weedy check is likely attributed to the larger stem and

Table 3 : Total Number of root nodules plant^{-1} of groundnut as influenced by different weed control treatments during 2022-23 and 2023-24.

Treatments	Total Number of root nodules plant^{-1}			
	20 DAS		40 DAS	
	2022	2023	2022	2023
T_1 Diclosulam 84% WDG @ 0.026 kg/ha PE *fb* IC + HW at 40 DAS	9.39	10.74	28.88	33.82
T_2 Diclosulam 84% WDG @ 0.026 kg/ha PE *fb* fluazifop-p-butyl 11.1% w/w + fomesafen 11.1% SL @ 0.250 kg/ha (RM) PoE (2-3 leaf stage of weed)	9.08	10.04	26.37	27.41
T_3 Diclosulam 84% WDG @ 0.026 kg/ha PE *fb* quizalofop-ethyl 7.5% + imazethapyr 15% EC @ 0.098 kg/ha (RM) PoE (2-3 leaf stage of weed)	9.17	10.67	27.29	31.86
T_4 Diclosulam 84% WDG @ 0.026 kg/ha PE *fb* propaquizafop 2.5% + imazethapyr 3.75% ME @ 0.125 kg/ha (RM) PoE (2-3 leaf stage of weed)	9.26	10.86	27.66	37.23
T_5 Pendimethalin 30%+ Imazethapyr 2% EC @ 0.8 kg/ha (RM) PE *fb* IC + HW at 40 DAS	9.95	11.22	29.14	37.72
T_6 Sodium acifluorfen 16.5%+ Clodinafop propargyl 8% EC @ 0.245 kg/ha (RM) PoE (2-3 leaf stage of weed) *fb* IC + HW at 40 DAS	8.91	10.27	26.16	28.72
T_7 IC *fb* HW at 20 and 40 DAS	9.87	11.94	30.21	39.07
T_8 Weedy check	8.44	8.73	21.14	18.22
S.E(m)±	0.62	1.14	1.17	2.27
C.D. at 5%	NS	NS	3.56	6.86
G.M.	9.26	10.56	26.98	31.76

root size resulting from the decreased weed population in these treatments. This reduction in weed competition creates a more favourable environment with increased soil moisture and nutrient availability which in turn facilitates accelerated cell development. These results are in confirmity with the findings of Dayal (2004), Kumar *et al*. (2007) and Kumbar *et al*. (2014).

Conclusion

Based on two years of experimentation, it can be concluded that among the herbicidal treatments, application of Pendimethalin 30% + Imazethapyr 2% EC @ 0.8 kg/ha (RM) pre-emergence *fb* Inter cultivation *fb* Hand weeding at 40 DAS resulted in higher growth attributes, such as higher plant height, dry matter accumulation, number of pinnate leaves, leaf area and total number of root nodules in the groundnut crop.

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