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Influence of integrated weed management on growth and yield of summer groundnut (*Arachis hypogaea* L.) under sub-montane region of Maharashtra

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Abstract
A field experiment was conducted during summer 2018 at Post Graduate Agronomy Research Farm, RCSM, College of Agriculture Kolhapur. The study was conducted with the objectives to evaluate the integrated weed management practices on growth and yield of summer groundnut (*Arachis hypogaea* L.) variety KDG-123 under Sub-Montane region of Maharashtra. The experiment was laid under randomized block design (RBD) with eight treatments with three replications. The growth, yield attributing characters and yield were found significantly highest in weed free check. However, among the integrated weed management treatments pendimethalin @ 1 kg a.i ha-1 + one hand weeding at 30 DAS (T_6) and pendimethalin @ 1 kg a.i ha-1 + one hand weeding at 30 DAS (T_5) were found statistically at par with each other, but significantly superior over rest of the treatments.

Keywords: Summer groundnut, integrated weed management, growth, yield, pendimethalin

Introduction
Groundnut (*Arachis hypogaea* L.) is an annual legume crop, belongs to family Leguminoseae. It knows king of vegetable oilseeds, poor man's nut. It's oil is good for nutritive value and culinary purpose. The demand for edible oil is rising day by day it is cultivated in about 120 countries under different agro-climatic zones between 40°S and 40°N (Anonymous, 2013) [1]. Groundnut is most important oilseed crop in India as well as Maharashtra. It contributes more than 50% edible oil production of country. Groundnut is most popular oilseed crop grown all three seasons. In India 80% groundnut produced is used for oil extraction, 11% as seed, 8% used as direct food and only 1% groundnut is exported (Anonymous, 2011) [2].

In India its well documented that productivity of groundnut under Indian condition is reduced due to numbers of factors *viz*. variation in monsoon, unavailability of irrigation water, poor management. Thus, summer cultivation is gaining the importance among the farmers it may be due to favourable climatic conditions, less incidence of pest and diseases. However, it is well documented that, yield loss due to weed infestation amounts to 80% in groundnut (Murthy *et al*.,1994) [10] while, weed infestation in summer groundnut (*Arachis hypogaea* L.) is one of the main factors for loss in yields to the tune of 17-84 per cent (Sasikala *et al*., 2006) [15]. Therefore, various weed management practices has been adopted to minimize the weed infestation thereby increasing the yield potential of summer groundnut which is need of the hour.

Materials and Methods
The field experiment was conducted during summer season of 2018 at Post Graduate Agronomy Research Farm, RCSM, College of Agriculture Kolhapur. The soil of the experimental plot was sandy clay loam with 90 cm depth, low in available N (234.94 kg ha^{-1}), moderately high in available P_2O_5 (22.85 kg ha^{-1}) and moderately high in available K_2O (271.20 kg ha^{-1}). The status of organic carbon, electrical conductivity and pH were 0.27%, 0.23 dSm^{-1}, 7.6 respectively.

The Kolhapur is situated on an elevation of 548 meters above the mean sea level on 16^0 42'.548 North latitude and 74^0 14'.329 East longitudinal and falls under the Sub-montane zone of NARP.

The annual mean maximum temperature ranges between 34 ^{0}C and 40 ^{0}C while, the annual mean minimum temperature varies from 6 ^{0}C to 10 ^{0}C. The mean humidity ranges between 78 to 95 per cent.

The total rainfall received during summer season (March to June) of 2018 was 63.9 mm received during 12th to 26th meteorological week. The highest evaporation ranged from 7.5 to 1.4 mm per day, minimum temperature varied from 9.4 ^{0}C to 21.4 ^{0}C and maximum temperature ranged from 27.4 ^{0}C to 38.4 ^{0}C. The relative humidity during the morning ranged between 68.1 to 90.5 percent and evening noted 25.8 to 78.5 percent.

The field experiment was laid under randomized block design (RBD) with eight treatments viz. (T1)Weedy check, (T2) One hoeing at 15 DAS + 1 HW at 30 DAS, (T3) One hoeing at 15 DAS + Quizalofop-p-ethyl @ 0.05 Kg.a.i.ha-1 at 25 DAS,(T4) Pendimethalin PE @ 1 Kg.a.i.ha-1, (T5) Pendimethalin PE @ 1 Kg.a.i.ha-1 + One Hoeing at 30 DAS, (T6) Pendimethalin PE @ 1 Kg.a.i.ha-1 + HW at 30 DAS, (T7) Pendimethalin @ 1 kg a.i. ha-1 + Quizalofop-p-ethyl @ 0.05 Kg.a.i.ha-1 at 25 DAS (POE) at 30 DAS and (T8) Weed free check. Each experimental unit was replicated thrice with 4.50 m x 3.0 m gross plot and 4.10 m x 2.40 m net plot size. The summer groundnut variety was KDG-123 sown by dibbling on First fortnight of February, 2018 at the spacing of 30 cm × 10 cm. The recommended dose of fertilizers 25:50:00 NPK kg ha^{-1} & FYM 5 tonnes ha^{-1} was applied at the time of sowing as basal dose and seeds were treated with *Rhizobium japonicum* at the rate 250 gm per 10 kg seeds and dried under shade and then used for sowing.

The various biometric observations of five randomly selected plants from each net plot were recorded. The bamboo pegs were fixed near the observational plants for easy location.

The growth contributing characters *viz*. plant height (cm), plant spread (cm), dry matter production plant^{-1} (g) and number of branches plant^{-1} were recorded periodically at 15 days interval and at harvest. Similarly the yield attributes from five observational plants were recorded at harvest *viz*. number of pods plant^{-1}, pod weight plant^{-1}, number of kernels pod^{-1} and 100 kernels weight (g), yield (pod, haulm and biological yield) were recorded from net plot and expressed in q ha^{-1}.

The data obtained from growth and yield characters under study was statistically analyzed by using standard method of "analysis of variance" as reported by Panse and Sukhatme (1967) [12]. The standard error was worked out for each factor under study and the critical difference (C.D.) at 5% level of significance was worked out whenever the results were significant.

Results and Discussion

Effect on Plant Height

It was observed from the table no. 1 that plant height was significantly influenced by different weed management treatments. The highest plant height at harvest was recorded in weed free check which was statistically at par with the treatments pre-emergence application of pendimethalin @ 1 kg a.i ha^{-1} + one hand weeding at 30 DAS (T_6) and pre-emergence application of pendimethalin @ 1 kg a.i ha^{-1} + one hoeing at 30 DAS (T_5) but significantly superior over rest of the treatments. The next best treatments were one hoeing at 15 DAS + one hand weeding at 30 DAS (T_2), one hoeing at 15 DAS + post emergence application of quizalofop-p-ethyl @ 0.05 kg a.i ha^{-1} at 25 DAS (T_7), pre-emergence application of pendimethalin @ 1 kg a.i. ha-1 + post emergence (T_4) which were significantly superior over weedy check (T_1). The lowest plant height was recorded in weedy check over rest of the treatments. Maximum plant height of groundnut in weed free check might be due to lower weed-crop competition for moisture, space, sunlight and greater availability of nutrient which resulted into higher growth of plant.

Table 1: Effect of the integrated weed management treatments on the growth attributing factors

Treatments	Plant height (cm)	Plant Spread (cm)	Number of branches plant^{-1}	Dry matter plant^{-1} (g)
T_1 -Weedy check	23.82	27.67	13.99	39.52
T_2 -One hoeing at 15 DAS + 1HW at 30 DAS	30.54	33.66	17.67	43.76
T_3- One hoeing at 15 DAS + Quizalofop - p- ethyl @ 0.05 kg a.i. ha^{-1} at 25 DAS.	29.86	33.03	17.45	43.68
T_4-Pendimethalin @ 1 kg a.i. ha^{-1}(PE)	28.61	31.71	16.27	42.05
T_5- Pendimethalin @ 1 kg a.i.ha^{-1} (PE)+ 1 Hoeing at 30 DAS	31.40	35.79	18.82	46.46
T_6-Pendimethalin @ 1 kg a.i.ha^{-1} (PE) + 1 HW at 30 DAS	32.20	36.18	19.81	47.68
T_7-Pendimethalin @ 1 kg a.i.ha^{-1} (PE) + Quizalofop-p-ethyl @ 0.05 kg a.i.ha^{-1} at 25 DAS.	29.58	32.15	16.45	42.71
T_8- Weed free check	33.33	37.62	20.67	48.15
S.E. ±	0.92	1.08	0.77	1.33
C.D.at 5%	2.78	3.27	2.35	4.03
General mean	29.96	33.48	17.64	44.25

The lowest plant height was recorded in weedy check might be due to continuous weed-crop competition for nutrient, moisture, air and space which might be lower the growth of plant. Similar results were reported by Sharma *et al.*, (2015) [16], Chaudhary *et al.*, (2017) [4] and Kalhpure *et al.*, (2013) [9].

Effect on plant spread (cm)

The mean plant spread was significantly influenced by different weed management treatments. The mean plant spread of weed free check treatment was significantly superior over rest of the treatments which was at par with the treatments pre-emergence application of pendimethalin @ 1 kg a.i ha^{-1} + one hand weeding at 30 DAS (T_6) and pre-emergence application of pendimethalin @1 kg a.i ha^{-1} + one hoeing at 30 DAS (T_5) but significantly superior over weedy check (T_1). The next best treatments were one hoeing at 15 DAS + one hand weeding at 30 DAS (T_2), one hoeing at 15 DAS + post emergence application of quizalofop-p-ethyl @ 0.05 kg a.i ha^{-1} at 25 DAS (T_3), pre-emergence application of pendimethalin @ 1 kg a.i. ha^{-1} + post emergence application of quizalofop-p-ethyl @ 0.05 kg a.i. ha^{-1} at 25 DAS (T_7) and

pre-emergence application of pendimethalin @ 1 kg a.i ha^{-1} (T_4). The significantly highest plant spread was recorded in treatment weed free check. This might be because of proper weed control in these treatments which reduces weed crop competition for nutrient, sunlight, CO_2, air and moisture that resulted in more plant height and ultimately more plant spread per plant, etc. The similar trend of observations was reported by Jat *et al*., (2011) [8].

Effect Number of Branches per Plant

At harvest mean number of branches per plant were found to be statistically significant. The maximum number of branches were observed in weed free check (T_8) which was statistically at par with the treatments pre-emergence application of pendimethalin @ 1 kg a.i. ha^{-1} + one hand weeding at 30 DAS (T_6) and pre-emergence application of pendimethalin @ 1 kg a.i ha^{-1} + one hoeing at 30 DAS (T_5), but significantly superior over rest of treatments. The next best treatments were one hoeing at 15 DAS + one hand weeding at 30 DAS (T_2), one hoeing at 15 DAS + post emergence application of quizalofop-p-ethyl @ 0.05 kg a.i ha^{-1} at 25 DAS (T_3), pre-emergence application of pendimethalin @ 1 kg a.i. ha^{-1} + post emergence application of quizalofop-p-ethyl @ 0.05 kg a.i. ha^{-1} at 25 DAS (T_7) and pre-emergence application of pendimethalin @ 1 kg a.i ha^{-1} (T_4). The significantly lowest number of branches plant^{-1} were recorded in weedy check. On an average at all crop growth stages maximum number of plant branches were observed in weed free check treatment and it was followed by all other treatments except weedy check. This might be because of proper weed control in respective treatments which resulted in less competition for nutrient, sunlight, moisture, space and finally it resulted in more plant height and more number of branches per plant. The similar observation was conformity with Sagvekar *et al*., (2015) [14].

Effect on dry matter (g)

The mean dry matter per plant of groundnut was 44.25 g at harvest. The maximum mean dry matter plant^{-1} was recorded in weed free check (T_8) which was statistically at par with the treatments pre-emergence application of pendimethalin @ 1 kg a.i ha^{-1} + one hand weeding at 30 DAS (T_6) and pre-emergence application of pendimethalin @ 1 kg a.i ha^{-1} + one hoeing at 30 DAS (T_5), but significantly superior over rest of the treatments. The next best treatments were one hoeing at 15 DAS + one hand weeding at 30 DAS (T_2), one hoeing at 15 DAS + post emergence application of quizalofop-p-ethyl @ 0.05 kg a.i ha^{-1} at 25 DAS (T_3), pre-emergence application of pendimethalin @ 1 kg a.i. ha^{-1} + post emergence application of quizalofop-p-ethyl @ 0.05 kg a.i ha^{-1} at 25 DAS (T_7) and pre-emergence application of pendimethalin @ 1 kg a.i. ha^{-1} (T_4) except weedy check (T_1). Effective control of weeds in weed free check plot reduces weed crop competition which increases biological yield. Similar results were reported by Sharma *et al*., (2015), Chaudhary *et al*., (2017) [4], Solanki *et al*., (2005) [19], Walia *et al*., (2007) [20], Pandian and Nambi (2002) [11].

Table 2: Effect of the integrated weed management treatments on the yield and growth attributing factors

Treatments	No. of pods plant^{-1}	Wt. of pods plant^{-1} (g)	No. of kernels pod^{-1}	100 kernels wt. (g)
T_1 -Weedy check	19.09	16.35	1.00	40.20
T_2 -One hoeing at 15 DAS + 1HW at 30 DAS	27.42	19.72	1.23	44.47
T_3-One hoeing at 15 DAS+ Quizalofop-p-ethyl @ 0.05 kg a.i. ha^{-1} at 25 DAS.	25.47	18.80	1.17	43.17
T_4-Pendimethalin @ 1 kg a.i. ha^{-1}(PE)	23.03	17.01	1.10	40.63
T_5- Pendimethalin @ 1 kg a.i.ha^{-1} (PE)+ 1 Hoeing at 30 DAS	30.37	20.95	1.33	45.37
T_6-Pendimethalin @ 1 kg a.i.ha^{-1} (PE) + 1 HW at 30 DAS	30.60	22.05	1.50	45.65
T_7-Pendimethalin @ 1 kg a.i.ha^{-1} (PE) + Quizalofop-p-ethyl @ 0.05 kg a.i.ha^{-1} at 25 DAS.	24.40	17.89	1.13	42.33
T_8- Weed free check	32.72	23.34	1.67	46.10
S.E. ±	0.93	0.83	0.373	1.73
C.D.at 5%	2.81	2.55	NS	NS
General mean	25.77	19.51	1.27	43.49

Effect on number of pods per plant

Mean number of pods per plant were significantly influenced by different weed management treatments. The significantly highest mean number of pods per plant were recorded in weed free check (T_8) (32.72) over weedy check (T_1) (19.09) whereas the treatments pre-emergence application of pendimethalin @ 1 kg a.i ha-1 + one hand weeding at 30 DAS (T_6) (30.60) and pre-emergence application of pendimethalin @ 1 kg a.i ha-1 + one hoeing at 30 DAS (T_5) (30.37) were at par with weed free check (T_8) and resulted maximum no. of pods per plant over rest of the treatments and followed by the other treatments one hoeing at 15 DAS + one hand weeding at 30 DAS (T_2), one hoeing at 15 DAS + post emergence application of quizalofop-p-ethyl @ 0.05 kg a.i ha-1 at 25 DAS (T_3),), pre-emergence application of pendimethalin @ 1 kg a.i. ha^{-1} + post emergence application of quizalofop-p-ethyl @ 0.05 kg a.i ha^{-1} at 25 DAS (T_7) and pre-emergence application of pendimethalin @ 1 kg a.i. ha^{-1} (T_4) were significantly superior over weedy check (T_1). It was found that number of pods plant-1 were reduced at harvest in case of weedy check due to weed crop competition for nutrients, air, moisture, sunlight. Similar trend of observations were reported by Sagvekar *et al.,* (2015) [14], Dutta *et al.,* (2005) [6] and Dubey *et al.,* (2010) [5].

Effect on Wt. of pods plant^{-1} (g)

The data revealed that the weight of pods plant^{-1} were significantly influenced by different weed control treatments. The weed free check (T_8) recorded maximum weight of pods plant^{-1}(23.34 g) which was at par with the treatments pre-emergence application of pendimethalin @ 1 kg a.i ha^{-1} + one hand weeding at 30 DAS (22.05) (T_6) and pre-emergence application of pendimethalin @ 1 kg a.i ha^{-1} + one hoeing at 30 DAS (20.95) (T_5) but significantly superior over rest of the treatments. However, the next best treatments were one hoeing at 15 DAS + one hand weeding at 30 DAS (T_2), one hoeing at 15 DAS + post emergence application of quizalofop-p-ethyl @ 0.05 a.i ha^{-1} at 25 DAS (T_3), T_7 and T_4

were significantly superior over weedy check (16.35 g). Similar results were reported by Sagvekar *et al.*, (2015) [14] Dutta *et al*., (2005) [6] and Dubey *et al.*, (2010) [5].

Effect on No. of kernels pod

The data indicates that the mean number of kernels pod^{-1} were not significantly affected by different treatments. This might be due to genetic characteristics. However, the maximum number of kernels pod^{-1} (1.67) were recorded by weed free check (T_8). Followed by the treatments pre-emergence application of pendimethalin @ 1 kg a.i ha^{-1} + one hand weeding at 30 DAS (T_6) (1.50) and pre-emergence application of pendimethalin @ 1 kg a.i ha^{-1} + one hoeing at 30 DAS (T_5) (1.33) which are comparable with weed free check (T_8). The lowest mean number of kernels pods^{-1} (1.00) were recorded in weedy check (T_1). Similar trend of results were reported by Ashok kumar and Rana (2003) [3] and Gunri *et al.*, (2014) [7].

Effect on 100 kernels wt. (g)

The data revealed that 100 kernels weight were not significantly affected by different weed management treatments. However, the treatment weed free check (T_8) recorded maximum 100 kernels weight (46.10 g) which was followed by the treatments pre-emergence application of pendimethalin @ 1 kg a.i ha^{-1} + one hand weeding at 30 DAS (T_6) (45.65 g) and pre-emergence application of pendimethalin @ 1 kg a.i ha^{-1} + one hoeing at 30 DAS (T_5) (45.37 g), one hoeing at 15 DAS + one hand weeding at 30 DAS (T_2), one hoeing at 15 DAS + post emergence application of quizalofop-p-ethyl @ 0.05 kg a.i ha^{-1} at 25 DAS (T_3), T_7 and T_4 which were superior over weedy check. The lowest 100 kernels weight (40.20 g) were recorded in weedy check. (T_1) Similar results was obtained by Gunri *et al.*, (2014) [7].

Effect on Pod Yield

The data pertaining to pod, haulm, biological yield and harvest index as influenced by different treatments are presented in Table 3. It was recorded that summer groundnut yield was influenced by various weed control treatments. The mean pod yield was 32.74 q ha^{-1}. The significantly highest pod yield (37.10 q ha^{-1}) was recorded from weed free check (T_8) which were statistically at par with the treatments pre-emergence application of pendimethalin @ 1 kg a.i. ha^{-1} + one hand weeding at 30 DAS (T_6) (36.45 q ha^{-1}) and pre-emergence application of pendimethalin @ 1 kg a.i ha^{-1} + one hoeing at 30 DAS (T_5) (35.82 q ha^{-1}) but significantly superior over rest of the treatments. The next best treatments were one hoeing at 15 DAS + one hand weeding at 30 DAS (T_2), one hoeing at 15 DAS + post emergence application of quizalofop-p-ethyl @ 0.05 kg a.i ha^{-1} at 25 DAS (T_3), T_7 and T_4 which were significantly superior over weedy check (T_1) (25.42 q ha^{-1}). The lowest pod yield in weedy check, it might be due to higher weed crop competition for nutrients, space, sunlight, moisture and CO_2 which reduces the pod yield. The magnitude of increase in pod yield with weed free treatment was 1.78, 3.57, 9.56, 12.42 and 13.31 per cent over the treatments T_6, T_5,T_2, T_3, T_7, T_4 and T_1 in that order respectively.

Thus, the effective weed control achieved in the earlier mentioned treatments resulted in enhancing various growth and yield contributing characters of groundnut and finally gave significantly higher pod yield over weedy check. Similar trend of observations were reported by Sagvekar *et al.*, (2015) [14], Gunri *et al*., (2014) [7] and Patel *et al*., (2006)

Table 3: Effect of the integrated weed management treatments on the yield of summer groundnut

Treatments	Pod yield (q ha^{-1})	Haulm yield (q ha^{-1})	Biological yield (q ha^{-1})	Harvest index (%)
T_1 -Weedy check	25.42	38.13	63.55	37.48
T_2 -One hoeing at 15 DAS + 1HW at 30 DAS	33.86	50.79	84.00	39.82
T_3-One hoeing at 15 DAS+ Quizalofop-pethyl @ 0.05 kg a.i. ha^{-1} at 25 DAS.	33.00	49.50	82.50	39.67
T_4-Pendimethalin @ 1 kg a.i. ha^{-1}(PE)	31.32	46.98	78.30	39.33
T_5- Pendimethalin @ 1 kg a.i.ha^{-1} (PE)+ 1 Hoeing at 30 DAS	35.82	53.73	89.55	39.97
T_6-Pendimethalin @ 1 kg a.i.ha^{-1} (PE) + 1 HW at 30 DAS	36.45	54.67	91.12	40.05
T_7-Pendimethalin @ 1 kg a.i.ha^{-1} (PE) + Quizalofop-p-ethyl @ 0.05 kg a.i.ha^{-1} at 25 DAS.	32.74	49.11	81.85	39.63
T_8- Weed free check	37.10	55.65	92.75	40.36
S.E. ±	1.02	1.54	2.80	1.30
C.D.at 5%	3.12	4.68	8.48	NS
General mean	32.74	49.82	83.04	39.54

Effect on Haulm Yield

The haulm yield was significantly influenced due to various weed control treatments. The mean haulm yield was 49.82 q ha^{-1}. The data pertaining to the effects of different weed management practices on haulm yield is revealed that significantly highest haulm yield was recorded by weed free check (55.65 q ha^{-1}) which was statistically at par with the treatments pre-emergence application of pendimethalin @ 1 kg a.i. ha^{-1} + one hand weeding at 30 DAS (T_6) (54.67 q ha^{-1}) and pre-emergence application of pendimethalin @ 1 kg a.i. ha^{-1}+ one hoeing at 30 DAS (53.73 q ha^{-1}) (T_5) over rest of the treatments. Next in order with treatments one hoeing at 15 DAS + one hand weeding at 30 DAS (T_2), one hoeing at 15 DAS + post emergence application of quizalofop-p-ethyl @ 0.05 kg a.i. ha^{-1} at 25 DAS (T_3), T_7 and T_4 which were significantly superior over weedy check (38.13 q ha^{-1}). The significantly lowest haulm yield was recorded in weedy check might be due to higher weed crop competition for nutrients, space, sunlight, moisture and CO_2. Thus, the effective weed control achieved in the earlier mentioned treatments resulted in enhancing various growth and yield contributing characters of groundnut and finally gave significantly higher pod yield over weedy check. Similar trend of observations were reported by Sheoran *et al*., (2015), Sagvekar *et al.*, (2015) [14], Gunri *et al*., (2014) [7] and Patel *et al*., (2006) [13].

Effect on Biological Yield

The biological yield was significantly influenced due to various weed management treatments. The mean biological yield was 83.04 q ha^{-1}. The data from table 3 noted the effect of different weed management treatments on biological yield revealed that significantly highest biological yield was

obtained from weed free check (T_8) (92.75 q ha^{-1}) except the treatments pre-emergence application of pendimethalin @ 1 kg a.i. ha^{-1} + one hand weeding at 30 DAS (T_6) (91.12 q ha^{-1}) and pre-emergence application of pendimethalin @ 1 kg a.i. ha^{-1} + one hoeing at 30 DAS (T_5) (89.55 q ha^{-1}) which were at par with the treatment weed free check and significantly superior over rest of the treatments. Next in order with the treatments i.e one hoeing at 15 DAS + one hand weeding at 30 DAS (T_2), one hoeing at 15 DAS + post emergence application of quizalofop-p-ethyl @ 0.05 kg a.i. ha^{-1} at 25 DAS (T_3), T_7 and T_4 which were significantly superior over weedy check. The significantly lowest biological yield was recorded in weedy check (63.55q ha^{-1}). The significantly lowest biological yield was recorded in weedy check due to higher weed crop competition for nutrients, space, sunlight, moisture and CO_2. Similar results were conformity with Chaudhary *et al*., (2017) [4], Sheoran *et al*., (2015), Sagvekar *et al.*, (2015) [14], Gunri *et al*., (2014) [7] and Patel *et al*., (2006) [13].

Effect on Harvest Index

The harvest index was not significantly influenced by different integrated weed management practices. The treatment weed free check (T_8) noted maximum harvest index (40.36 %) followed by the treatments pre-emergence application of pendimethalin @ 1 kg a.i. ha^{-1} + one hand weeding at 30 DAS (T_6) (40.05%) and pre-emergence application of pendimethalin @ 1 kg a.i. ha^{-1} + one hoeing at 30 DAS (T_5) (39.97%) , one hoeing at 15 DAS + one hand weeding at 30 DAS (T_2), one hoeing at 15 DAS + post emergence application of quizalofop-p-ethyl @ 0.05 kg a.i ha^{-1} at 25 DAS (T_3), T_7 and T_4 . The lowest harvest index (37.48%) was recorded by weedy check (T_1) plot. This might be due to weedy check plot has minimum pod yield and biological yield. Due to higher weed crop competition weed acquire more space, nutrient, moisture and CO_2 as compare to groundnut crop. This reduces pod yield and biological yield leading to minimum harvesting index. Similar trend of observations were reported by Sharma *et al*., (2015) [16], Patel *et al.*, (2006) [13] and Singh *et al.*, (2014) [18].

Conclusion

The yield of summer groundnut is affected mainly due to weed infestation, hence it is necessary to adopt multiple approaches to suppress the weed, thereby to improve growth and yield of crop. It was revealed from the current study that, weed free treatment recorded the highest growth characters, yield attributes and yield of groundnut which is comparable with the treatments pre-emergence application of pendimethalin @ 1 kg a.i. ha^{-1} + one hand weeding at 30 DAS and pre-emergence application of pendimethalin @ 1 kg a.i. ha^{-1} + one hoeing at 30 DAS.

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