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Effect of weed management practices on weed control, growth attributes, yield and economics in *Rabi* groundnut (*Arachis hypogaea* L.)

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ABSTRACT

A field trial was conducted during *Rabi* season of 2013-14 in farmer's field in Sandhapal village of Chhendipada block in Angul district in Odisha to study the effect of weed management practices on weed control, growth attributes, yield and economics in *Rabi* groundnut .The treatments comprised of different weed management practices *viz.*, T_1- Post-emergence application of quizalofop ethyl 0.05 kg ha^{-1} *fb* one hand weeding at 25 DAS, T_2- Farmers practice of one hand weeding at 25 DAS and T_3-Weedy check. The experimental trial was laid out in Randomized Block Design with thirteen replications. The results revealed that post-emergence application of quizalofop ethyl 0.05 kg ha^{-1} *fb* one hand weeding at 25 DAS recorded maximum weed control efficiency (71.4 %) with minimum dry weed biomass (79.2 g m^{-2}) at harvest. The same treatment also produced significantly higher pod yield (22.34 q ha^{-1}), plant height (40.13 cm), number of pods plant^{-1} (19.5), 100 pod weight (81.7 g), 100 seed weight (36.2 g), total dry matter accumulation(2.16 to 25.5 g plant^{-1}), CGR (5.32 to 26.40 g m^{-2} day^{-1}), gross return (Rs.89360 ha^{-1}) and B:C ratio(2.20) with additional net return of Rs.10280 ha^{-1} as compared to farmers practice and weedy check. Thus, application of quizalofop ethyl 5 per cent 1.0 kg ha^{-1} *fb* one hand weeding appeared to be effective, economically viable for weed control, crop growth, higher pod yield and net profit.

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INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is a valuable oilseed and accounts for 33 per cent area and 45 per cent production in India. India ranks first among groundnut growing countries in the world with 6.74 million ha. area and 7.99 million tonnes production. Integrated weed management in groundnut has great importance as groundnut suffers heavily due to weed competition in the early stage because of its short structure and initial slow growth (Bhale *et al*., 2012). Groundnut is the major

oilseed crop of Odisha covering 0.26 m ha area with a production 0.44 m tonnes which is about 33.3 per cent of the total oilseed coverage area of the state. Area under groundnut crop in Angul district during *Kharif* and *Rabi* are 8030 and 2270 hectares, respectively with a average productivity of 19.09 q ha^{-1} (Anonymous, 2012). Groundnut weeds comprises diverse plant species from grasses to broad leaved weeds and sedges and cause substantial yield losses (15-75%). Weeds also affect groundnut through the production of harmful allelochemicals. Herbicides were found to be selective in controlling many weeds in monocropping as well in cropping system (Jat *et al.*, 2011). Knowledge about competitive aspects of weeds and the critical stages at which the weeds compete to the maximum extent with the crop is an important aspect. The co-existence of weeds with the crop plants cause considerable reduction in yield in crop plants by affecting both the growth and yield components. Uncontrolled weeds may reduce the yield up to 76 per cent (Granamurthy and Balasubramaniyam, 1998). Chemical herbicide and cultural methods are effective to control the weeds in groundnut crop (Patel *et al*., 1997). Application of post emergence herbicides shall be more use in control the weeds.

Hand weeding, is time consuming, highly expensive and is not feasible during critical period of weed competition due to scarcity of labour. Keeping this in view present investigation was under taken to study the effect of weed management practices on weed control, growth attributes, yield and economics in *Rabi* groundnut.

MATERIAL AND METHODS

A field trial was conducted during *Rabi* season of 2013-14 in farmer's field in Sandhapal village of Chhendipada block in Angul district in Odisha to study the effect of weed management practices on weed control, growth attributes, yield and economics of *Rabi* groundnut. The experimental site lies in 85^0 4´ 22" to 85^0 4´ 31" E longitude and 20^0 49´ 32" to 20^0 49´ 49" N latitude and average elevation of 195 m above sea level. Climate of the region is fairly hot and humid monsoon and mild winter with average annual rainfall of 1401.9 mm. The mean maximum and mean minimum temperature vary from 39.6°C in April to 23.5°C in December and from 23.5^0 C in June to 11.3^0 C in January, respectively. The soil of the site is slightly acidic in reaction (pH-5.5 to 6.1), sandy loam in texture with medium organic carbon content (0.50 to 0.63 %), medium nitrogen (275 to 291 kg ha^{-1}), low phosphorus (9.0 to 10.7 kg ha^{-1}) and medium potassium(178 to 188 kg ha^{-1}) contents. The treatments comprised of different weed management practices *viz.*, T_1- Post-emergence application of quizalofop ethyl 5 per cent 0.05 kg ha^{-1} at 15 DAS *fb* one hand weeding at 25 DAS, T_2- Farmers practice of one hand weeding at 25 DAS and T_3-Weedy check. The experimental trial was laid out in Randomized Block Design with thirteen replications. The seeds of groumdnut cv.TMV 2 was sown on 4th week of December as per treatment by line sowing and harvested during 1st week of April and fertilizers were applied @ 20:40:40 kg NPK ha^{-1}. Full dose of P, K and half dose of N of RDF were applied as basal and rest N was applied at 30 DAS. Herbicide (Quizalofop ethyl) was sprayed at 15 DAS with manually operated knapsack sprayer using a spray volume of 500 litres water per hectare. All other recommended agronomic and plant protection measures were adopted to raise the crop. The biometric observations on weeds and crops were recorded following standard procedures. Weed density m^{-2} was sampled randomly at ten places with the help of one square meter quadrates at 15, 25, 35, 60 DAS and dry weed biomass m^{-2} at harvest were recorded. The weed control efficiency (WCE) was calculated by using the formula (Kondap and Upadhyay, 1985).

$$WCE = \frac{(DWC - DWT)}{DWC} \times 100$$

where,

DWC = Dry weight of weeds (g m^{-2}) under control plot; DWT = Dry weight of weeds (g m^{-2}) under treated plot

Crop growth rate (CGR) was determined with the formula:

$$\frac{W_2 - W_1}{t_2 - t_1}$$

where,

W_1 and W_2 are dry weight (g m^{-2}) of plants at time t_1 and t_2, respectively.

Economic analysis was done by calculating cost of cultivation, gross return, net return and B:C ratio. Available soil nutrients were determined following the standard procedures (Jackson, 1973). The datas were

statistically analyzed applying the techniques of analysis of variance and the significance of different sources of variations were tested by error mean square of Fisher Snedecor's 'F' test at probability level 0.05(Cochran and Cox, 1977).

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads:

Weed flora and weed density :

The trial field was infested with two categories of weeds. The total number of weeds species was 9 out of which *Cynodon dactdylon, Digitaria sanguinalis* among grasses; *Phyllanthus niuri, Xanthium strumarium, Celosia argentia* among broaleaved were predominant throughout the cropping period. At 60 DAS grasses and broadleaved weeds, on an average, constituted 54.2, 45.8 per cent of total weed population (Table 1). Herbicide treatment significantly reduced the weed population compared to those of farmer's practice or weedy check during this period. Maximum weed density at 60 DAS (Table 2) was recorded in weedy check (101.4 m^{-2}) followed by farmer's practice of one hand weeding and minimum weed density(29.6 m^{-2}) was observed in post-emergence application of quizalofop ethyl 0.05 kg ha^{-1} *fb* one hand weeding at 25 DAS. This was due to application of herbicide which might have prevented the germination of susceptible weed spp and also reduced the growth of germinated weeds by inhibiting the process of photosynthesis (Muzik, 1970). Total weed density at all stages (at 15, 25, 35 and 60 DAS) are differed significantly among the treatments and post-emergence application of quizalofop ethyl 0.05 kg ha^{-1} *fb* one hand weeding at 25 DAS recorded lower weed population than farmers practice and weedy check. Similar observations were recorded in groundnut by Mene *et al*. (2003).

Weed dry biomass and weed control efficiency :

Weedy check recorded significantly higher weed dry biomass (277.3 g m^{-2}) at harvest which was significantly more than other treatments because of higher weed intensity and its dominance in utilizing the sunlight, nutrients, moisture etc. The lowest weed dry biomass (79.2 g m^{-2}) was registered under post-emergence application of quizalofop ethyl 0.05 kg ha^{-1} *fb* one hand weeding at 25 DAS at harvest (Table 2). This may be due to effective control of weeds during early stages of crop growth by herbicide and in later stages removal of both intra and inters row weeds by hand weeding. This is in accordance with Patra and Nayak (2001). Shetty and Rao (1977) also reported that weed dry matter weighed during harvest indicates the trend of lesser weed dry matter values in pigeonpea for better weed management treatments.

The weed control efficiency (WCE) was significantly higher in herbicide treatment with hand weeding and lower in farmers practice. At harvest (Table 2) post-emergence application of quizalofop ethyl 0.05 kg ha^{-1} *fb* one hand weeding at 25 DAS recorded the

Table 1 : Effect of different treatments on weed composition m^{-2} in groundnut at 60 DAS

Sr. No.	Weed species	T_1	T_2	T_3
	Monocot			
1.	*Cynodon dactdylon*	2.0	6.6	18.2
2.	*Digitaria sanguinalis*	1.5	6.0	16.2
3.	*Commelina benghalensis*	1.5	4.9	15.0
4.	*Echinochloa glabrescens*	1.3	4.2	14.4
	Total monocot	6.2	21.7	63.8
	Dicot			
1.	*Parthenium hysterophous*	3.5	1.9	7.5
2.	*Phyllanthus niuri*	6.5	5.2	9.0
3.	*Xanthium strumarium*	5.9	4.7	8.1
4.	*Argimone mexicana*	2.8	2.7	6.6
5.	*Celosia argentia*	4.7	2.1	6.4
	Total dicot	23.4	16.5	37.6
	Grand total	29.6	38.2	101.4

higher weed control efficiency (71.4 %) as compared to farmers practices (63.4 %). Similar observations were found in soybean by Sharma (2000).

Total dry matter acucumulation plant^{-1} and Crop growth rate :

Among all the stages of crop growth, post-emergence application of quizalofop ethyl 0.05 kg ha^{-1} *fb* one hand weeding at 25 DAS has recorded significantly higher total dry matter production at 25, 50, 75 and 100 Days after sowing (2.16, 5.67, 22.17 and 25.50 g plant^{-1}, respectively) followed by farmers practice (Table 3). This was due to the effective control of broad spectrum weeds due to herbicide treatment in combination with cultural practices. Weedy check recorded the lower dry matter production (1.91, 5.21, 17.25 and 20.05 g plant^{-1}, respectively) may be due to higher weed population and dry weight of weeds and more competition by weeds with crop for nutrients, light and moisture at all the stages of the crop growth. Murthy *et al*. (1992) have reported significant reduction in the total dry matter accumulation in groundnut under weedy check.

Post-emergence application of quizalofop ethyl 0.05 kg ha $^{-1}$ *fb* one hand weeding at 25 DAS recorded (Table 3) the higher crop growth rate (CGR) value 5.62, 26.40 and 5.32 g m^{-2} day^{-1} during 25-50, 50-75 and 75-100 DAS respectively which are at par with farmers practices. Weedy check recorded the lowest CGR value 5.27, 19.26 and 4.48 g m^{-2} day^{-1} during 25-50, 50-75 and 75-100 DAS respectively. These observations might be due to the increase of metabolically active tissue in groundnut and as obtained less to the plant growth (Samant *et al.*, 2014a). The CGR values were increasing progressvely with time reaching the highest at 50-75 DAS in all the treatments attributed to high vegetative biomass production. During seedling stage crop growth was affected by toxic secretions and later on the crop and weeds develop, competition for dry matter accumulation becomes more dominant limiting factor in crop growth (Martin and Radamecher, 1960).

Plant height, umber of pods plant^{-1}, 100 pod weight and 100 seed weight :

Post-emergence application of quizalofop ethyl 0.05 kg ha^{-1} *fb* one hand weeding at 25 DAS recorded (Fig. 1) the maximum number of pods plant^{-1} (19.5) which is 42.3 per cent higher than farmer's practice might be due to lesser weed population, lowest dry weed biomass and removal of weeds regularly at early and later stages by post emergence herbicide and hand weeding (Samant and Prusty, 2014). The same treatment also produced

Table 2: Effect of different treatments on weed density, dry weed biomass and weed control efficiency

Treatments	Weed density m^{-2}				Dry weed biomass (g m^{-2}) at harvest	Weed control efficiency (%) at harvest
	15 DAS	25 DAS	35 DAS	60 DAS		
T_1 : Post-emergence application of quizalofop ethyl 0.05 kg ha $^{-1}$ *fb* one hand weeding at 25 DAS	61.8	33.3	10.0	29.6	79.2	71.4
T_2: Farmers practice (one hand weeding at 25 DAS)	81.7	80.6	18.7	38.2	101.4	63.4
T_3: Weedy check	90.5	89.5	97.6	101.4	277.3	
S.E.±	3.301	1.558	4.941	4.225	4.347	
C.D. (P=0.05)	9.635	4.549	14.419	12.331	12.686	

Table 3 : Effect of different treatments on total dry matter accumulation and crop growth rate

Treatments	Total dry matter accumulation (g plant^{-1})				Crop growth rate (g m^{-2} day^{-1})			Pod yield (q ha^{-1})
	25 DAS	50 DAS	75 DAS	100 DAS	25-50 DAS	50-75 DAS	75-100 DAS	
T_1 : Post-emergence application of quizalofop ethyl 0.05 kg ha $^{-1}$ *fb* one hand weeding at 25 DAS	2.16	5.67	22.17	25.50	5.62	26.40	5.32	22.34
T_2: Farmers practice (one hand weeding at 25 DAS)	2.08	5.48	20.84	23.76	5.45	24.58	4.68	19.82
T_3: Weedy check	1.91	5.21	17.25	20.05	5.27	19.27	4.48	12.25
S.E.±	0.058	0.053	0.520	0.675	0.041	0.690	1.027	0.628
C.D. (P=0.05)	0.17	0.156	1.516	1.971	0.119	2.014	2.996	1.834

maximum plant height (40.13 cm), 100 pod weight (81.7 g) and 100 seed weight (36.2 g) whereas minimum was found in weedy check (Bhondave *et al*., 2009). Similar observations were found in pigeonpea by Singh *et al.* (2012).

Pod yield :

Post-emergence application of quizalofop ethyl 0.05 kg ha $^{-1}$ *fb* one hand weeding at 25 DAS recorded (Table 3) pod yield 22.34 q ha^{-1} which is significantly higher (12.7 %) than the farmers practice because of the herbicides prevented the germination of weed and reduced the growth of weed and minimum crop weed competition through out crop growth period. Minimum pod yield was recorded in weedy check (12.25 q ha$^{-1)}$ may be due to vigorous weed growth and suppression in crop growth (Dixit *et al*., 2012). Similar results have also been reported in groundnut by Kori *et al.* (2000).

Economics :

Among the treatments, Post-emergence application of quizalofop ethyl 0.05 kg ha^{-1} *fb* one hand weeding at 25 DAS recorded (Fig. 2) the maximum gross return (Rs. 89360 ha^{-1}) and B:C ratio(2.20) with additional net return of Rs.10280 ha^{-1} as compared to farmers practice owing to more number of pods plant^{-1}, pod weight results in higher pod yield. Similar results have also been reported by Tewari *et al.* (1989). Minimum cost of cultivation

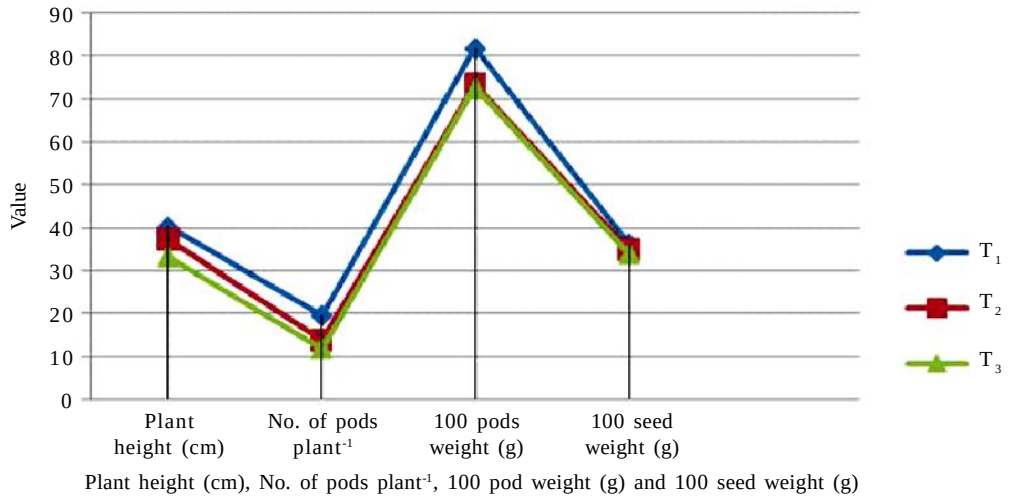

Fig. 1 : Effect of different treatments on plant height, no of pods plant^{-1}, 100 pod weight, and 100 seed weight

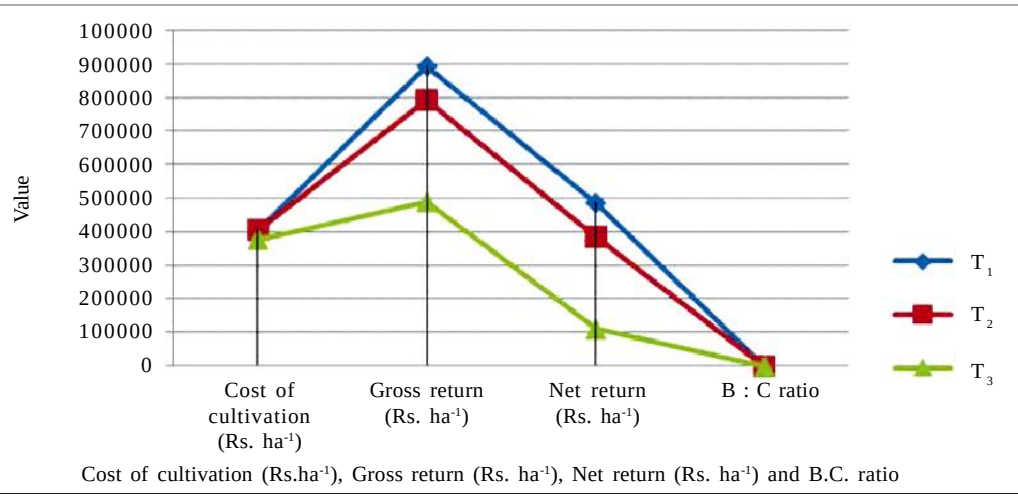

Fig. 2 : Effect of different treatments on cost of cultivation, gross return , net return and B:C ratio

(Rs.37803 ha^{-1}) was occurred in weedy check in comparison to other treatments due to reduction of cost towards weeding. Weedy check recorded the lowest net return (Rs.11197 ha^{-1}). These results were in conformity with findings of Mene *et al.* (2003) in groundnut.

Conclusion:

It can be concluded from the above trial that the post emergence application of quizalofop ethyl @1.0 kg ha^{-1} at 15 DAS with one hand weeding at 25 DAS effectively controls the weeds in groundnut which considerably reduced the weed infestation registering higher weed control efficiency, higher pod yield. Thus, it appeared to be effective, economically viable for weed control, crop growth, higher pod yield and net profit.

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