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EFFICACY OF THE SELECTED HERBICIDES ON GROWTH AND YIELD PERFORMANCE OF GROUNDNUT

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Abstract: The present Study was conducted in the Instructional farm of Krishi Vigyan Kendra, Bhawanipatna in the district Kalahandi of Odisha during *Rabi* 2016-17 with five cultivars viz. Devi (ICGV 91114) (say V_1), ICGV-07220 (say V_2), Tag-24 (say V_3), Kadiri-6 (say V_4) & Kissan (say V_5) with Seven herbicide treatments such as control (without weeding), Butachlor, Alachlor, Weed free, Quizalofop ethyl, Imazethapyr & Oxyflurofen having three replication to study the "Efficacy of the selected herbicides in controlling Growth and yield performance of groundnut". Under this study, the morphological character such as plant height, no. of branches, leaf area and total biomass accumulation was recorded highest in weed free plots followed by Butachlor treated plots among all the treatments. The highest number of nodules was exhibited by weed free plots Followed by Butachlor. Similar trend was found on regards to number of effective nodules per plant. The yield attributing characters such as number of pods per plant and test weight of pods significantly increased in weed free treatments followed by Butachlor among all the treatments. Highest yield was contributed by weed free treatment (13.6 q/ha) followed by Butachlor (12.8 q/ha) which increased respectively over control. Besides this oil percentage content was noted highest in weed free plot (49.3 %) followed by Butachlor (47.5%).
Keywords: Herbicide, growth, yield, morphological characters, groundnut.

Introduction

Groundnut (Arachis hypogaea L.) is known as the '*king*' of oilseeds. It is one of the most important food and cash crop of our country. Groundnut is also called as *wonder nut* and poor men's cashew nut. In India, groundnut was grown on 6.22 million ha during 2008-09 with a total production of 7.34 million tonnes and an average productivity of 1180 kg ha^{-1}. Groundnut contributes about 40 per cent to the total oilseeds production in our country. At this level of contribution the projected demand for groundnut by 2020 AD will be about 14 million tonnes with the present production level of around 8.2 million tonnes. Therefore, a gap of about 5.8 million tonnes needs to be bridged. This calls for a growth rate of about 2.2 percent $annum^{-1}$ in production. Weeds are the most important constraints which limits the production in groundnut in India, because it is highly susceptible to weed infestation due of its slow growth rate in the initial stages up to 45 DAS, short plant height and underground

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pod bearing habit. Unlike other crops, weed interfere with pegging, pod development and harvesting of groundnut during different stages of crop growth besides competing for essential resources. Groundnut weeds comprise diverse plant species from grasses to broad leaves weeds and sedges and causes substantial yield loss (15-75%) which is more in branch type than Virginia type groundnut. Therefore, weeds reduce crop yields by competing with crops mainly for light, nutrients, water, and carbon dioxide (Anderson 1983).The yield reduction due to weeds has been reported up to 30-80 % (Gills et al., 1986). It is recorded that serious loss (25-40%) in pods yield groundnut is due to weeds infestations especially during the early stages of crop development (Reddy 1984). Weeds compete with crop for soil moisture, nutrients and light and reduce the yield. They also harbour and serve as alternative host for pest and diseases. The critical period of crop weed competition in groundnut was observed to be 4 to 8 weeks after sowing (Santelmann and Hill, 1969), as groundnut is naturally short with slow seedling emergence and initial growth. The loss in yield of groundnut pods due to weed competition ranged from 30 to 40% (Chandra Singh and Gupta 1973). Nutrient losses due to crop weed competition were 38.8, 9.2 and 23.3 N, P and K $kgha^{-1}$ respectively (Naidu et al. 1982). Herbicide gives timely and effective control of weeds and traditional methods give better aeration and soil condition along with weed control. Therefore use of herbicide alone or in combination with cultural practices has become a necessity to control weeds.

Materials and Methods

This Study entitled as “Efficacy of the selected herbicides in controlling Growth and yield performance of groundnut” was conducted at instructional farm of Krishi Vigyan Kendra, Kalahandi during Rabi season of 2016-17. Groundnut seed were treated with Rhizobium culture before sowing @ 200g per 10-12 Kg kernel. One cart load of FYM was applied to the soil uniformly before 3rd ploughing. Basal dose of N: P: K @ 20:40:40 Kg/ha in the form of urea, single super phosphate and murate of potash respectively, was giving to plots much prior to sowing. The five varieties viz. Devi (ICGV91114), ICGV 07220, Tag-24, Kadiri-6 and Kissan were sown in lines after treatment with Rhizobium culture .The lines were drawn 25 cm apart by trench hoe and seeds were sown in furrows at equal depth maintaining a spacing of 10cm. Proper dose of herbicide mixed well with required quantity of water and allow it to stand for 5-10 minutes. Then it was sprayed with the help of a high volume knapsack sprayer. The spraying of herbicide was given as uniform blanket spray over the soil. All the spraying operations were done during evening hours.

Plant height

Plant height was measured from the ground level up to the tip of the freshly opened leaf emerging from the main shoot. Observations were taken at 90 DAS from the selected sample plant at random which were 5 in numbers from each treatment.

Number of Branches per plant

Total number of primary branches arising from the main stem was counted from 5 different plants. They were taken from different site of treated plot and mean was taken as number of branches per plant.

The details of the treatments are presented in Table.1

Varieties	Treatments (Sub Plot)
Devi (ICGV 91114) (say V_1)	Control
ICGV 07220(say V_2)	Imaze thapyr
TAG 24(say V_3)	Alachlor
Kadiri 6 (say V_4)	Oxyflurofen
Kissan (say V_5)	Quizalofop ethyl
	Weed free
	Butachlor

Leaf Area per plant

The Leaf area per plant was measured by using Leaf Area Meter. Five plants were selected randomly from different corner of a treated plot & leaf area of each plant was measured. The mean of these five plants were considered as a leaf area of the plant.

Total Dry Matter

Five plants were uprooted randomly from different site of a treated plot. Root portion and pods of all five plants separated and washed it thoroughly, dried at 80^0C in hot air oven for 48 hours. After drying weighed it separately then total biomass of a plant was calculated. Observation of this parameter was recorded at 90 DAS.

Number of nodules per plant and number of effective nodules per plant

Five Plants were chosen at random and uprooted along with intact roots. The root portions were washed thoroughly and the number of nodules and effective nodules of each plant were counted under simple microscope.

Number of pods per plant

Five plants which were selected at random from each experimental plot were uprooted carefully and number of pods and effective pods were counted individually**.**

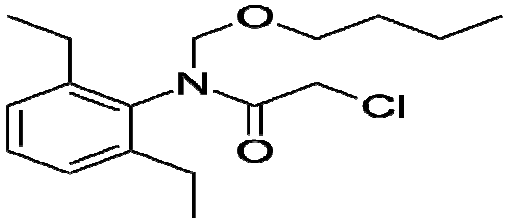
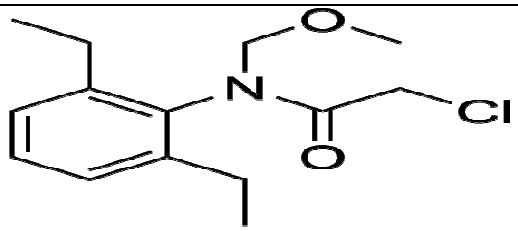
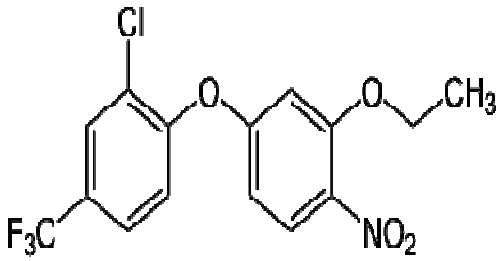
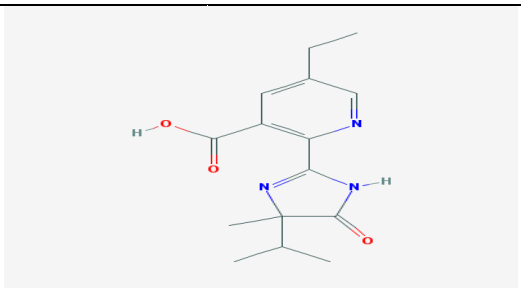
Test weight

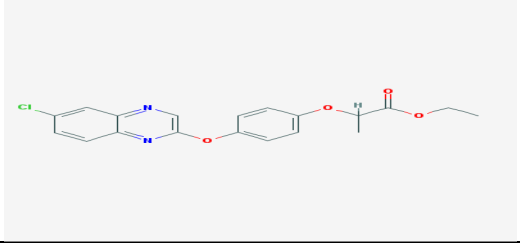
100 kernels were chosen from the sample plants at random and were weighed in Gram (g) after three consecutive sun drying for 4 hours a day under paper cover**.**

Pod yield

The pod yield from the individual net plots was recorded in kg after 3 consecutive sun drying.

The chemical details of the herbicides are presented in Table.2

Sl. No.	Chemical name	Structural formula	Chemical details	
01	Butachlor		**Chemical formula**	$C_{17}H_{26}ClNO_2$
			Molar mass	311.85 g·mol^{-1}
			Density	1.0695 g/cm^3
02	Alachlor		**Chemical formula**	$C_{14}H_{20}ClNO_2$
			Molar mass	269.767 g/mol
			Density	1.12 g/ml
03	Oxyflurofen		**Chemical formula**	$C_{15}H_{11}ClF_3NO_4$
			Molar mass	361.7g·mol^{-1}
			Density	1.53 g/cm^3
04	Imazethapyr		**Chemical formula**	$C_{15}H_{11}ClF_3NO_4$
			Molar mass	361.7g·mol^{-1}
			Density	1.53 g/cm^3

05	**Quizalofop ethyl**		**Chemical formula** $C_{19}H_{17}ClN_2O_4$ **Molar mass** 372.805g·mol^{-1} **Density** 1.35 g/cm^3

Oil Estimation

Two grams of Groundnut seeds from each treatment were crushed in a glass mortar and placed in a thimble. The thimble containing crushed seeds was placed in a Soxlet extraction apparatus connected with a pre-weighed extraction (receiving) Flask containing 150 ml of petroleum ether .Extraction flask was heated on water bath for about 3 to 4 hrs. The solvent (Petroleum ether) was circulated through the condenser of Soxlet apparatus continuously over the entire refluxing period. Receiving flask was detached and placed in an oven at 60-80^O C for complete removal of petroleum ether, the receiving flask containing oil was calculated as follows (Singh, 1997).

Harvested oil was computed from percent of oil present in kernel.

Percentage Oil= W_0/W_s

W_0= Weight of oil in gram

(Final weight of receiving flask with oil-initial weight of receiving flask)

W_s= Weight of seeds taken in gram

Results and Disscussion

Plant height

As revealed from the results Data presented in Table-3 indicated that there was tremendous effect of herbicide on plant height. The highest plant height (43.0 cm) was noted in weed free plots followed by Butachlor (42.9 cm) among all the treatments. However among the varieties significantly higher effects were observed in V_5 (Kissan) followed by V_2 (ICGV 07220). Significant difference among the treatment and varieties were found.

Number of branches per plant

Data pertaining to number of branches of plant due to the effect of application of herbicide are presented at **Table-3**. It was noted that the number of branches per plant differed significantly among the treatments. At 90 DAS maximum number of branches were recorded in Butachlor treated plots (9.4) followed by Quizalofop ethyl treated plots (9.3), where as lowest value was noted from Control i.e wed check plots (6.9). However among the varieties

significantly higher effects were observed in V_5 (Kissan) followed by V_2 (ICGV 07220). Significant difference among the treatment and varieties were found.

Leaf Area

Data presented in Table-3 revealed that, the leaf area was increased due to the application of herbicides. Leaf area observation taken At 90 DAS revealed that highest leaf area 1468.4 cm^2 and minimum 878.9 cm^2 were found in Quizalofop ethyl treated plots and control plots respectively. However among the varieties significantly higher effects were observed in V_5 (Kissan) followed by V_2 (ICGV 07220). Significant difference among the treatment and varieties were found.

Leaf Area Index (LAI)

Data presented in Table-3 revealed that, the leaf area index was decreased due to the application of herbicides. Leaf area index observation taken At 90 DAS revealed that highest leaf area index 5.2 and minimum 4.3 were found in weed free plots and control plots respectively. However among the varieties significantly higher effects were observed in Kadiri 6 (V_4) followed by V_5 (Kissan). Significant difference among the treatment and varieties were found.

Total Biomass

Variation in total biomass due to application of herbicide was found in **Table-3,** which indicated that the maximum biomass production was exhibited by Quizalofop ethyl treated plots (T_4) (46.21gm/plant) followed by Butachlor treated plots (T_6) (46.14 gm/plant) where as the minimum or lowest value of the same was shown in control plots (32.06gm/plant). However among the varieties significantly higher effects were observed in Kadiri 6 (V_4) followed by V_5 (Kissan). Significant difference among the treatment and varieties were found.

Number of Nodules per Plant

Comparison between the number of nodule at 90 DAS, maximum nodules were observed in weed free plots (T_5) (36.2) followed by Butachlor treated plots (T_6) (36.13), where as the minimum value of the same was shown in control plots (T_0) (31.30). However among the varieties significantly higher effects were observed in V_5 (Kissan) followed by Kadiri 6 (V_4). Significant difference among the treatment and varieties were found.

Number of effective nodule

Comparison between the number of effective nodules at 90 DAS, maximum nodules were observed in weed free plots (T_5) (36.2) followed by Butachlor treated plots (T_6) (31.6), where

as the minimum value of the same was shown in control plots (T_0) (28.9). However among the varieties significantly higher effects were observed in V_5 (Kissan) followed by Kadiri 6 (V_4). Significant difference among the treatment and varieties were found.

Total number of pods per plant

Comparison between the total number of pods plant^{-1} at 90 DAS, maximum number of pods plant^{-1} were observed in weed free plots (T_5) (33.6) followed by Butachlor treated plots (T_6) (31.9), where as the minimum value of the same was shown in control plots (T_0) (27.2). However among the varieties significantly higher effects were observed in V_5 (Kissan) followed by (V_1) Devi (ICGV 91114). Significant difference among the treatment and varieties were found.

Pod Yield

Due to the application of herbicides in Groundnut crop, there was variation in yield among the treatments and also in varieties. Results in **Table-3** indicated that the highest yield was obtained in weed free plots (13.60 q/ha) followed by Butachlor treated plots (12.8 q/ha) over the control. However among the varieties significantly higher effects were observed in V_2 (ICGV 07220) followed by V_1 Devi (ICGV 91114). Significant difference among the treatment and varieties were found.

Test Weight (100 Kernel Weight)

Results in **Table- 3** indicated that maximum test weight was exhibited by weed free plot (59.8 gm) followed by Butachlor (56.7 gm) and Oxyflurofen (51.8 gm). However among the varieties significantly higher effects were observed in V_1 Devi (ICGV 91114) followed by V_2 (ICGV 07220). Significant difference among the treatment and varieties were found.

Oil percentage

Results in **Table 3** indicated that due to the application of herbicides, there was significant increase in oil percentage among the treatments and varieties. The maximum oil percentage was found in weed free plots (49.3%) followed by Butachlor treated plots (47.5%) and the minimum value of the same was found in control or weed check plot (42.3%). However among the varieties significantly higher effects were observed in V_4 Kadiri 6 followed by V_2(ICGV 07220). Significant difference among the treatment and varieties were found.

Conclusion

Weeds are unwanted and undesirable plant, which manifest losses to agricultural produce by competing with crop plant for nutrient, soil moisture and sunlight. The extend of losses depends upon type of weed species, severity of weed infestation, duration of weed

infestation, competing ability of crop plant, which affect weed and crop growth. Crop yield reduction is directly co-related with weed competition. Under this study, the morphological character such as plant height, no. of branches, leaf area and total biomass accumulation was recorded highest in weed free plots followed by Butachlor treated plots among all the treatments. The highest number of nodules was exhibited by weed free plots Followed by Butachlor. Similar trend was found on regards to number of effective nodules per plant. The yield attributing characters such as number of pods per plant and test weight of pods significantly increased in weed free treatments followed by Butachlor among all the treatments. Highest yield was contributed by weed free treatment (13.6 q/ha) followed by Butachlor (12.8 q/ha) which increased respectively over control. Besides this oil percentage content was noted highest in weed free plot (49.3 %) followed by Butachlor (47.5%). In economic point of view Butachlor gives the better result over weed free plots and also suggests ICGV 07220(V_2) in context of district Kalahandi of Odisha for better returns.

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Table No. 3 Efficacy of selected herbicides on growth and yield performance of Ground nut

Treatments	Plant height (cm)	No. of branches	Leaf area plant^{-1} (cm^2)	LAI	Total Bio mass (g plant^{-1})	No. of nodules plant^{-1}	No. of eff. Nodules plant^{-1}	Total no. of pods plant^{-1}	Pod yield(q ha^{-1})	Test weight(g)	Oil %
T_0	31.0	6.9	878.9	4.3	32.06	31.3	28.9	27.2	11.3	41.9	42.3
T_1	41.4	8.1	1186.5	4.5	45.27	36.4	31.5	31.4	13.3	54.6	46.8
T_2	35.3	7.1	986.4	4.5	37.38	32.6	30.6	29.6	11.5	45.6	43.7
T_3	38.9	8.3	1072.1	4.4	39.45	33.8	31.0	30.1	11.6	51.8	45.4
T_4	42.6	9.3	1468.4	4.9	46.21	35.7	30.8	30.8	12.7	48.5	46.5
T_5	43.0	8.7	1172.0	5.2	45.32	36.2	32.6	33.6	13.6	59.8	49.3
T_6	42.9	9.4	1386.0	5.1	46.14	36.1	31.5	31.9	12.8	56.7	47.5
Varieties											
V_1	30.4	6.4	1165.12	5.23	41.94	34.89	30.87	31.87	13.21	51.87	45.89
V_2	41.2	8.8	1164.23	5.18	42.08	33.45	30.48	31.48	13.34	51.48	46.45
V_3	35.4	7.3	1164.35	5.12	42.34	34.16	31.26	31.26	12.98	51.26	46.16
V_4	39.4	8.1	1160.26	5.46	42.86	34.87	30.89	30.98	12.83	50.98	46.87
V_5	42.8	9.3	1165.34	5.41	42.61	34.95	30.98	31.98	12.67	51.98	45.95

		SE(m)±	C.D.	CV%			SE(m)±	C.D.	CV%			SE(m)±	C.D.	CV%
Plant height	V	0.010	0.031	0.11	LAI	V	0.021	0.069	2.08	No. of eff. nodules	V	0.029	0.095	0.43
	T	0.012	0.035	0.12		T	0.059	0.167	4.87		T	0.043	0.122	0.54
	VxT	0.021	0.061			VxT	0.096	0.272			VxT	0.073	0.208	
	TxV	0.028	0.078			TxV	0.132	0.372			TxV	0.096	0.272	
No. of Branches	V	0.018	0.060	1.01	TDM	V	0.031	0.102	0.34	Total no. of pods	V	0.125	0.408	1.87
	T	0.020	0.056	0.93		T	0.040	0.114	0.38		T	0.139	0.393	1.75
	VxT	0.035	0.101			VxT	0.069	0.199			VxT	0.243	0.704	
	TxV	0.044	0.126			TxV	0.090	0.255			TxV	0.311	0.879	
Leaf area	V	0.183	0.598	0.07	No. of nodules	V	0.040	0.132	0.54	Pod yield	V	0.028	0.091	1.02
	T	0.128	0.362	0.04		T	0.042	0.119	0.47		T	0.040	0.115	1.26
	VxT	0.249	0.741			VxT	0.074	0.215			VxT	0.068	0.196	
	TxV	0.286	0.809			TxV	0.094	0.265			TxV	0.091	0.256	

		SE(m)±	C.D.	CV%			SE(m)±	C.D.	CV%
Test weight	V	0.030	0.099	0.27	Oil percentage	V	0.053	0.174	0.54
	T	0.022	0.062	0.17		T	0.045	0.128	0.38
	VxT	0.042	0.126			VxT	0.084	0.245	
	TxV	0.049	0.139			TxV	0.101	0.286	