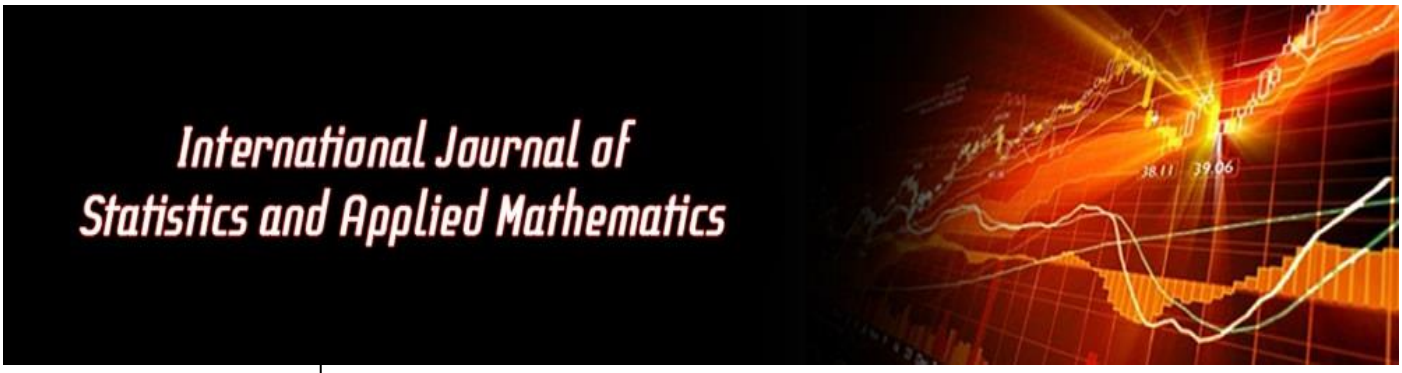

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To workout the economics of weed control treatments in groundnut

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Abstract
A field experiment entitled "Evaluation of post-emergence application of quizalofop-p-tefuryl (4.41% EC) on groundnut (*Arachis hypogaea* L.)" was conducted during *Kharif* 2012 at ARS, Chintamani. The soil of the experimental site was red sandy loam in texture, neutral in reaction and medium in available nitrogen, low in available phosphorus and medium in potassium. The experiment consisted of 12 treatments laid out in RCBD with three replications. The predominant weed flora observed in the experimental field were, *Cyperus rotundus*, *Digitaria marginata*, *Dactyloctenium aegyptium*, *Cynodon dactylon*, *Commelina benghalensis Celosia argentia*, *Amaranthus viridis.* The results revealed that pre-emergence application of pendimethalin @ 1.0 kg a.i. ha^{-1} followed by post emergence application of quizalofop-p-tefuryl (4.41% EC) @ 1000 ml ha^{-1} at 15 DAS recorded significantly maximum net returns (Rs. 26915 ha^{-1}) and B:C ratio (1.93) was also high with the same treatment. There was no residual effect of quizalofop-p-tefuryl (4.41% EC) on succeeding finger millet crop.

Keywords: *Arachis hypogaea* L, groundnut, weeds, cost benefit ratio, finger millet crop

Introduction
Groundnut (*Arachis hypogaea* L.), king of oilseeds, belongs to the family Leguminoceae and commonly called as poor man's almond. It is the world's fourth most important source of edible oil and third most important source of vegetable protein. The groundnut is used for different purposes *viz.*, food, animal feed and industrial raw material. Seeds are valued both for its oil and protein content as the seeds contain about 40-45 per cent oil, 25 per cent protein and 18 per cent carbohydrates in addition to minerals and vitamins. Groundnut oil contains a higher proportion of unsaturated fatty acids, including essential fatty acids like linolenic and linoleic acids (Desai *et al.*, 1999) [4]. It is also fairly rich in calcium, iron and vitamin B complex like thiamine, riboflavin, niacin and vitamin A. It has multifarious usages; it is not only used as a major cooking medium for various food items but also utilized for manufacture of soaps, cosmetics, shaving creams, lubricants, etc. In fact, it plays a pivotal role in economy of India.

Groundnut occupies an area of 20.9 million hectares in the world with a total production of 35.4 million tonnes. Out of which, 13 million hectares are in Asia, mostly in India (5.3 m ha) and China (4.6 m ha), are the major countries. The rest of the cultivation is in Sub-Saharan Africa (7.79 m ha) and in North and Central America (0.44 m ha). India occupies the first place in acreage but stands second in production. In India, groundnut is cultivated under 6 million ha with production of 5.5 million tonnes. Gujarat, Andhra Pradesh, Tamil Nadu and Karnataka are the leading producers and contribute about 70 per cent of the area and account for 75 per cent of the total production (Anon., 2010) [1]. In India, groundnut crop is mainly grown under rainfed conditions and energy starved marginal lands which are prone to the vagaries of monsoons and also groundnut crop is affected by severe pests, diseases and weeds infestation leading to low productivity of less than nine quintals per hectare.

Groundnut is grown extensively during *kharif* season under rainfed condition, wherein it encounters severe weed infestation especially in the early crop growth stages.

Initial slow growth rate of groundnut paves way for weeds to compete with the crop for resources such as nutrients, light, space and conserved soil moisture. The critical period of crop-weed competition was found to be the first four to eight weeks after sowing. Weed competition during this period is critical, as the seeding emergence requires seven to ten days coupled with initial slow growth compared to weed emergence and growth. These aspects affect the crop substantially. Later, the co-existence of weeds with the crop plants causes considerable reduction in yield by affecting both growth and yield components. Delayed weeding is less effective besides being more expensive. Controlling weeds by hand weeding or intercultural operations does not ensure weed free environment all through the crop growth period right from the very early initial stage. Further, weeding cannot be carried out quickly and at required stage in cropped areas during the season, owing to labour scarcity and expensive wages, under such situations, the use of herbicides has gained momentum. However, majority of the farmers in India are reluctant to use herbicides mainly due to lack of knowledge on selectivity, time, method and dosage of application, prohibitive cost and non-availability of herbicides at their door step.

Materials and Methods

A study on "Evaluation of post-emergence application of quizalofop-p-tefuryl (4.41% EC) on groundnut (*Arachis hypogaea* L.)" was carried out at Agricultural Research Station, Chintamani, during kharif 2012, University of Agricultural Sciences, Bengaluru. There were twelve treatment combinations details of the material used and methods adopted during the course of investigation are described.

Treatments details: There were twelve treatment combinations Treatments details T_1:Quizalofop-p-tefuryl (4.41% EC) @ 750 ml ha^{-1} at 15 DAS, T_2: Quizalofop-p-tefuryl (4.41% EC) @ 1000 ml ha^{-1} at 15 DAS, T_3:Quizalofop-p-tefuryl (4.41% EC) @ 1250 ml ha^{-1} at 15 DAS, T_4: Quizalofop-p-tefuryl (4.41% EC) @ 2000 ml ha^{-1} at 15 DAS, T_5: Pendimethalin @ 1.0 a.i. kg ha^{-1} as a pre-emergence application, T_6: Pendimethalin @ 1.0 a.i. kg ha^{-1} as a pre-emergence application fb post-emergence application of Quizalofop-p-tefuryl (4.41% EC) @ 750 ml ha^{-1} at 15 DAS, T_7: Pendimethalin @ 1.0 a.i. kg ha^{-1} as a pre-emergence application fb post-emergence application of Quizalofop-p-tefuryl (4.41% EC) @ 1000 ml ha^{-1} at 15 DAS, T_8: Pendimethalin @ 1.0 a.i. kg ha^{-1} as a pre-emergence application fb post-emergence application of Quizalofop-p-tefuryl (4.41% EC) @ 1250 ml ha^{-1} at 15 DAS, T_9: Pendimethalin @ 1.0 a.i. kg ha^{-1} as a pre-emergence application of post-emergence application of Quizalofop-p-tefuryl (4.41% EC) @ 2000 ml ha^{-1} at 15 DAS, T_{10} : Imazethapyr 10% SL @ 75 g a.i. ha^{-1} at 15 DAS, T_{11}: Intercultural operation + Hand weeding at 20 and 40 DAS, T_{12}: Weedy check comprising of pre-emergence application of pendimethalin @ 1.0 kg a.i. ha^{-1} and post-emergent application of quizalofop-p-tefuryl (4.41% EC), at the four different rates 750, 1000, 1250 and 2000 ml ha^{-1} and imazethapyr 10% SL @ 75 g a.i. ha^{-1} and the combination of pre-emergence and post-emergence herbicides. Along with this, two hand weeding carried out at 20 and 40 DAS and two intercultivations at 20 and 40 DAS and unweeded control were applied. Finally worked out the economics of cost and benefit ratio for all the treatments

Results and Discussion

Economics

The gross returns, net returns cost of cultivation and benefit ratio differed significantly due to different weed control treatments (Table 1).

Table 1: Economics of groundnut as influenced by weed control treatments

Treatments	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C
T_1: Quizalofop-p-tefuryl (4.41% EC) @ 750 ml ha^{-1} at 15 DAS	26880	41960	15080	1.56
T_2: Quizalofop-p-tefuryl (4.41% EC) @ 1000 ml ha^{-1} at 15 DAS	27280	42000	14720	1.53
T_3: Quizalofop-p-tefuryl (4.41% EC) @ 1250 ml ha^{-1} at 15 DAS	27680	42600	14920	1.53
T_4: Quizalofop-p-tefuryl (4.41% EC) @ 2000 ml ha^{-1} at 15 DAS	28880	47720	18840	1.65
T_5: Pendimethalin @ 1 kg a.i. ha^{-1} as a pre-emergence application	27165	44520	17355	1.63
T_6: Pendimethalin @ 1 kg a.i. ha^{-1} *fb* Quizalofop-p-tefuryl (4.41% EC) @ 750 ml ha^{-1} at 15 DAS	28365	46000	17635	1.62
T_7: Pendimethalin @ 1 kg a.i. ha^{-1} *fb* Quizalofop-p-tefuryl (4.41% EC) @ 1000 ml ha^{-1} at 15 DAS	28765	55680	26915	1.93
T_8: Pendimethalin @ 1 kg a.i. ha^{-1} *fb* Quizalofop-p-tefuryl (4.41% EC) @ 1250 ml ha^{-1} at 15 DAS	29165	41040	11875	1.40
T_9: Pendimethalin @ 1 kg a.i. ha^{-1} *fb* Quizalofop-p-tefuryl (4.41% EC) @ 2000 ml ha^{-1} at15 DAS	30365	35880	5515	1.18
T_{10}: Imazethapyr 10% SL @ 75 g a.i. ha^{-1} at 15 DAS as a post-emergence application	26617	40720	14103	1.52
T_{11}: Hand weeding at 20 & 40 DAS + two intercultural operations at 20 & 40 DAS	28055	63920	35865	2.27
T_{12}: weedy check	25005	19240	-5765	0.70

DAS-Days After Sowing, fb-followed by, a.i.-active ingredient

Gross returns (Rs. ha^{-1})

Significantly higher gross returns were realized with hand weeding at 20 & 40 DAS + two intercultural operations at 20 & 40 DAS (Rs. 63920 ha^{-1}) followed by Pre-emergence of application of pendimethalin @ 1 kg a.i. ha^{-1} fb post-emergence application of quizalofop-p-tefuryl (4.41% EC) @ 1000 ml ha^{-1} at 15 DAS (Rs. 55680 ha^{-1}), which was on par with each other. The lower gross return was noticed in weedy check (Rs. 19240 ha^{-1}).

Cost of cultivation (Rs. ha^{-1})

Regarding the cost of cultivation, pre-emergence application of Pendimethaline @ 1 kg a.i. ha^{-1} *fb* post emergence application of quizalofop-p-tefuryl (4.41% EC) @ 2000 ml ha^{-1} at 15 DAS (Rs. 30365 ha^{-1}) recorded a higher cost of cultivation as compared to other treatments. Whereas the lowest cost of cultivation was with weedy check (Rs. 25005 ha^{-1}).

Net returns (Rs. ha^{-1})

A significant variation was observed with net returns due to different weed control practices. Hand weeding at 20 and 40 DAS + two intercultural operations at 20 and 40 DAS recorded significantly higher net returns (Rs. 35865 ha^{-1}). Among the herbicidal weed control treatments pre-emergence application of pendimethalin @ 1 kg a.i. ha^{-1} *fb* post-emergence application of quizalofop-p-tefuryl (4.41% EC) @ 1000 ml ha^{-1} at 15 DAS (26965 Rs. ha^{-1}), Weedy check (Rs.-5765 ha^{-1}) showed a lower net returns as compared to other treatments.

Significantly higher Benefit cost ratio was noticed with hand weeding at 20 and 40 DAS + two intercultural operations at 20 and 40 DAS (2.27), followed by pre-emergence application pendimethalin @ 1 kg a.i. ha^{-1} *fb* post-emergence application of quizalofop-p-tefuryl (4.41% EC) @ 1000 ml ha^{-1} at 15 DAS (1.93) which was on par with each other. Whereas lower benefit cost ratio (0.70) was observed in weedy check. The gross returns, net returns and benefit cost ratio were differed significantly due to different weed control treatments (Fig. 8). Among weed control treatments, significantly higher gross returns were obtained with hand weeding at 20 & 40 DAS + two intercultural operations at 20 & 40 DAS (Rs. 63920 ha^{-1}), followed by pre-emergence application of pendimethalin @ 1.0 kg a.i. ha^{-1} *fb* post-emergence application of quizalofop-p-tefuryl (4.41% EC) @ 1000 ml ha^{-1} at 15 DAS (Rs. 55680 Rs. ha^{-1}), which was on par with each other. The highest returns obtained in the above treatments were mainly due to higher yields as a result of higher weed control efficiency. Similar relevant work done by Rajsingh *et al*., 1991 [3], Guggari *et al*., 1996 [5], Kumara, 2004 [6].

Significantly higher net returns were realized with hand weeding at 20 & 40 DAS + two intercultural operations at 20 & 40 DAS (Rs.35865 ha^{-1}), the next best treatment was pre-emergence application of pendimethalin @ 1.0 kg a.i. ha^{-1} *fb* post-emergence application of quizalofop-p-tefuryl (4.41% EC) @ 1000 ml ha^{-1} at 15 DAS (Rs. 26915 ha^{-1}) as compared to other treatments such as pre-emergence application opendimethalin @ 1.0 kg a.i. ha^{-1} *fb* post-emergence application of quizalofop-p-tefuryl (4.41% EC) @ 1250 ml ha^{-1} at 15 DAS, and pre-emergence application of pendimethalin @ 1.0 kg a.i. ha^{-1} *fb* post-emergence application of quizalofop-p-tefuryl (4.41% EC) @ 2000 ml ha^{-1} at 15 DAS, and post-emergence application of quizalofop-p-tefuryl (4.41% EC) @ 750, 1000, 1250 and 2000 ml ha^{-1} at 15 DAS. Higher net returns in these treatments were mainly due to higher yield and lower cost of cultivation compared to other and weedy check. Benefit cost ratio was significantly higher hand weeding at 20 & 40 DAS + two intercultural operations at 20 & 40 DAS (2.27) as compared to other treatments, mainly due to lower cost of weed control. The next best treatment was pre-emergence application of pendimethalin @ 1.0 kg a.i. ha^{-1} *fb* post-emergence application of quizalofop-p-tefuryl (4.41% EC) 1000 ml ha^{-1} at 15 DAS (1.93). Similar work done by Sukhadia et al., 2000 [2], Kori et al., 2000 [8].

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