Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-7: 4592-4598

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-7 pp. 4592-4598**
Journal homepage: http://www.ijcmas.com

Original Research Article

Effect of Weed Management Practices on Weed Dynamics, Yield and Economics of Elephant Foot Yam (*Amorphophallus paeoniifolious*)

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A B S T R A C T

An experiment was conducted to find out most suitable weed management practice for weed management in elephant foot yam during the year 2015-16 to 2017-18 at Agricultural Research Farm, Dholi of Tirhut College of Agriculture under Dr. Rajendra Prasad Central Agricultural University, Pusa (Bihar) under sandy loam soil. It was found that the herbicide Quizalofop-p-ethyl alone or in combination with other herbicides performed better than all other herbicides tested. It may due to its better efficacy towards controlling narrow leaved weeds particularly against the most dominant weed of the field *Sorghum halepanse*. The most effective combination of herbicides was pendimethalin followed by quizalofop-p-ethyl (T_7) which may be due to weed control right from the early stage up to about a month by the application of pendimethalin and thereafter control of most dominating and vigorous weed *Sorghum halepanse* by the application of quizalofop-p-ethyl. Lowest weed population, weed dry matter at 30, 60 and 90 days after sowing/planting and net return were recorded under T_{10} (Hand weeding thrice at 25, 50 & 75 days after sowing) and was significantly superior than all other treatments, it could not showed highest B: C ratio even after realizing highest tuber yield (44.4 t/ha) and net return (Rs.399237/ha). Best weed index (11.36 %) was recorded by T_7 and it was equally good with T_{10} with respect to tuber yield. Significant highest net return (Rs.399237/ha) was recorded by T_{10} than all other treatments but was found at par with T_7 (Rs.366807/ha). B: C ratio recorded by T_7 (2.59) was significantly superior than the other treatments except T_9 (2.53) and T_{10} (2.50). Highest weed population, weed dry matter, weed index were recorded under control treatment which ultimately reflected in realization of lowest tuber yield, net return and B: C ratio due to highest competition exerted by weeds for different above and below ground growth factors with the crop plants.

Keywords

Elephant foot yam, weed management, weed index, herbicides, tuber yield, net return

Introduction

Elephant Foot Yam (*Amorphophallus paeoniifolious)* is one of the most important tuber crops of India and the world as well. It is also an important tuber crop grown in Bihar particularly in northern Bihar. In the present scenario of changing climate, it has assumed more importance than before due to some unparallel edges over other crops like its capacity to produce even in adverse climatic conditions without affecting much on its productivity, high yield potential of tubers and feed for animals with in short period of time. Its farming is also eco-friendly because of less use of agro-chemicals. An underground stem tuber, is one of the most popular tuber crops,

extensively used as a favourite vegetable by millions of people in India. It has both nutritional and medicinal value and is usually consumed as cooked vegetable. It has high dry matter production capability per unit area than most of the other vegetables. Elephant foot yam is a remunerative and profitable stem tuber crop. The crop is gaining popularity due to its shade tolerance, easiness in cultivation, high productivity, less incidence of pests and diseases, steady demand and reasonably good price. Tubers are mainly used as vegetable after thorough cooking (Thangam *et al.*, 2013).

The yield potential of elephant foot yam is seriously affected by weeds mainly for the competition of nutrients, water, light, air and space owing to the very slow initial growth of this crop. Hand weeding by hired labourers is generally done by the farmers but due to scarcity and unavailability of labourers during peak period, increasing labour wages, time consuming and cumbersome operation, it becomes imperative to go for chemical weed control due to its edge over manual weeding to overcome these problems (Singh *et al.*, 2014). Therefore, weed management is necessary especially during initial period of about two to three months of crop growth. Keeping these facts in view, this experiment was undertaken.

Materials and Methods

The experiment was conducted at Agricultural Research Farm, Dholi of Tirhut College of Agriculture under Dr. Rajendra Prasad Central Agricultural University, Pusa (Bihar) during the period from 2015-16 to 2017-18. The soil of the experimental plot was sandy loam with pH value of 8.2. Initial soil analysis value of experimental field was: available nitrogen (218.4 kg/ha), phosphorus (17.6 kg/ha), and potassium (138.5 kg/ha); zinc (0.48 mg/kg) and boron (0.40 mg/kg). There were eleven treatments i.e., T_1: Pendimethalin @ 1.0 kg /ha (PE), T_2: Quizalofop-p-ethyl @ 75 g /ha (PoE -25 DAS), T_3: Quizalofop-p-ethyl @ 100 g /ha (PoE-25 DAS), T_4: Imazethapyr @ 50 g /ha (PoE-20 DAS), T_5: Imazethapyr @ 75 g /ha (PoE-20 DAS), T_6: Halosulfuron @ 67.5 g /ha (Early Emergence-15 DAS), T_7:T1 + T2 (40 DAS), T_8:T1 + T4 (40 DAS), T_9:T6 + T2 (40 DAS), T_{10}: (HW) (25, 50 & 75 DAS) and T_{11}: Control. Variety taken of elephant foot yam was Gajendra. Tubers of about 500 g size was planted at a spacing of 75 cm x 75 cm. Recommended dose of manures and fertilizers i.e., 18.0 t/ha of compost/FYM with 60: 40: 60 kg N: P_2O_5: K_2O /ha were applied uniformly in all the treatments. The experiment was laid out in randomized block design with three replications. Weed samples were taken at 30, 60 and 90 days after planting randomly from three places using a quadrate of 0.25 m^2 and converted into weed population/ m^2. Thereafter weeds were oven dried and recorded as weed dry weight/ m^2. Most dominating weed of the field was *Sorghum halepanse.* Other important weeds found were- *Cynodon dactylon, Cyperus rotundus, Physallis minima, Cannabis sativa, Convolvulus arvensis, Anagallis arvensis,Leucas aspera* etc. Tubers were harvested from net area of 9.0 m^2 and converted into t/ha. Net return (Rs./ha) and B: C ratio were also worked out. Analysis were done following standard statistical procedures. Other standard package of practices were also followed.

Results and Discussion

Treatments of different herbicides alone or in combinations including hand weeding thrice (25, 50 and 75 DAS) and one control treatment when applied, it produced significant effect on weed count, weed dry

biomass, weed index (%), tuber yield, net return and B: C ratio of sweet potato (Table.1 & Fig. 1, 2, 3 & 4).

Significant lowest value of weed population and dry weight at 30, 60 and 90 DAS and significant highest tuber yield were recorded under the treatment where thrice hand weeding were done at 25, 50 and 75 days after sowing/planting which may obviously be due to frequent (thrice) weeding that led to weakening of weeds by making their food reserves waste. Herbicides pendimethalin and quizalofop-p-ethyl alone or in combination with each other were found much effective than halosulfuron and imazethapyr at lower dose during early growth stage. However, all the herbicides testes either alone or in combination were found very effective in reducing the number of weeds as compares to control treatment at 30 DAS. Corresponding dry weight of weeds under T_1 and T_7 didn't follow the similar trend. Although, dry weight of weeds obtained in weed free treatment was significantly superior than the other treatments but was found at par with T_1 and T_7 which may be due to initial control of weeds by the pre-emergence application of pendimethalin. Other treatments follow similar trend. Weed population recorded at 60 and 90 DAS in weed free treatment (T_{10}) were also significantly lowest than all other treatments except T_7 and T_9 may be due to effective weed control up to a month by the application of pendimethalin and thereafter by quizalofop-p-ethyl @ 75 g/ha at 40 DAS as post emergence application (Table.1 and Fig.1). Among herbicides, halosulfuron @ 67.5 g /ha as early emergence at 15 DAS was found least effective in reducing weed population at 60 and 90 DAS which might be due to less efficacy towards other weeds as against *cyperus species* but corresponding dry weights of weeds at 60 and 90 DAS under T_7 and T_9 were not at par with T_{10} which may be due to comparatively higher dry weights of weeds under T_7 and T_9 as compared to the weeds found in T_{10}.

Weed index calculated in T_7 was found lowest which was followed by T_9 which may be due to the minimum competition for growth factors offered by weeds in these treatments as compared to other treatments. Highest weed index was estimated in control treatment only due to the highest competition for growth factors offered by weeds in control treatment as compared to other treatments. With regard to tuber yield, weed free treatment (thrice hand weeding-T_{10}) was found significantly superior than all treatments except T_7 due to least competition with weeds for growth factors which in turn resulted into better plant growth and so the tuber yield (44.4 t/ha). Among different herbicides tested, quizalofop-p-ethyl at both the doses alone or in combination with other herbicides effectively reduced the weed population particularly the most dominant weed of the field *Sorghum halepanse* by the application of quizalofop-p-ethyl; minimized crop – weed competition and contributed in equally good tuber yield realization and were found statistically at par among themselves. The best treatment which was equally good with weed free treatment(T_{10}) in terms of tuber yield and net return was T_7 (Pendimethalin @ 1.0 kg /ha (PE) followed by quizalofop-p-ethyl @ 75 g /ha (PoE - 40 DAS) with significantly higher value of B: C ratio (2.59) which may be due to weed control right from the early stage up to about a month by the application of pendimethalin and thereafter control of most dominating and vigorous weed *Sorghum halepanse* and other narrow leaved weeds by the application of quizalofop-p-ethyl @ 75 g /ha (PoE - 40 DAS) which provided congenial conditions for the growth of the plants (Singh *et al.,* 2016).

Table.1 Effect of weed management practices on weed dynamics, yield and economics of elephant foot yam

Treatments	Total weed population /m^2			Total dry weight of weeds (g/m^2)			Weed index (%)	Yield (t/ ha)	Net return Rs./ha)	B:C ratio
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS				
T1	40.6	74.3	96.3	10.2	53.5	102.8	38.31	27.7	188049	1.83
T2	45.7	71.5	88.6	16.3	38.1	86.1	20.27	35.8	308745	2.35
T3	42.6	58.4	74.1	15.2	30.7	71.4	18.49	36.6	319831	2.40
T4	61	84.5	94.7	22.3	56.6	99.7	36.30	28.6	202723	1.90
T5	52.9	72.1	81.8	18.3	46.4	85.4	33.93	29.7	218341	1.96
T6	68.5	86.2	104.5	35.7	74.5	128.3	42.24	25.9	162709	1.72
T7	31.6	44.8	56.4	10.3	26.8	60.1	11.36	39.8	366807	2.59
T8	43.4	59.5	67.7	15.6	41.6	77.5	29.47	31.7	246785	2.08
T9	34.8	48.4	64.8	14.6	39.2	66.2	13.81	38.7	351467	2.53
T10	17.1	33.5	44.6	4.6	10.4	33.7	-----	44.4	399237	2.50
T11	143.6	196.5	183.4	49.9	151.6	238.8	52.93	21.1	91487	1.41
CD (P=0.05)	10.6	17.4	19.6	7.5	13.8	20.3		4.8	47583	0.09

Fig.1

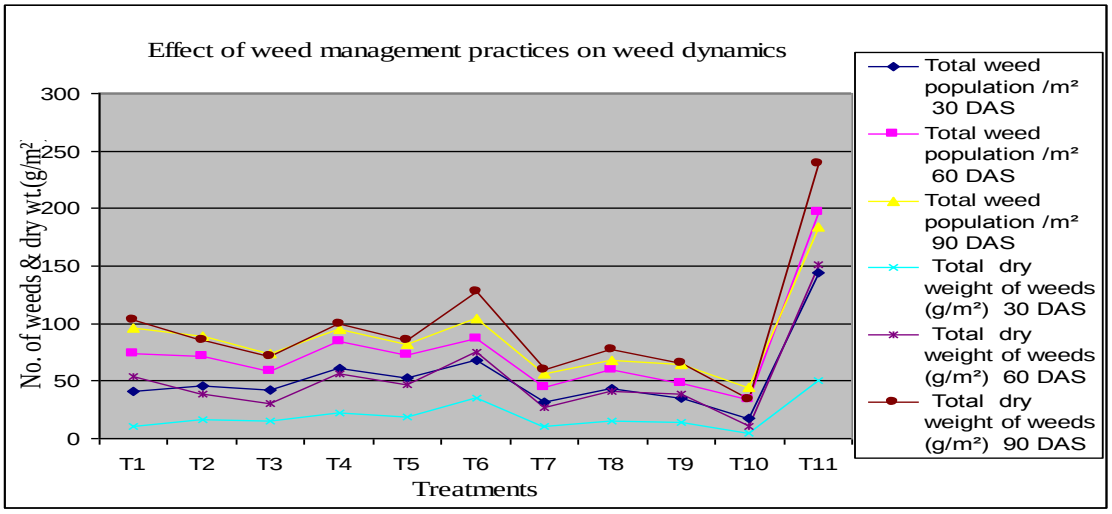


Fig.2

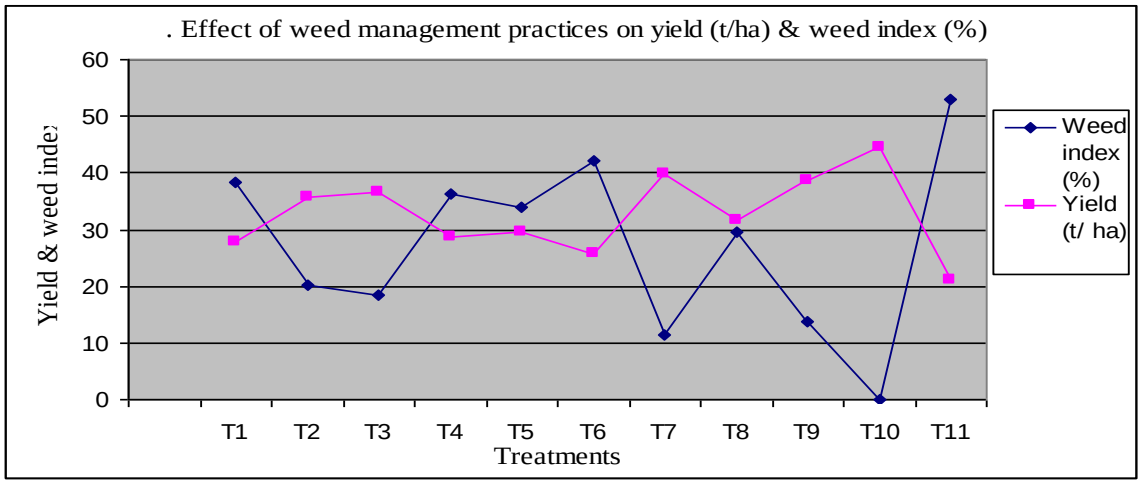


Fig.3

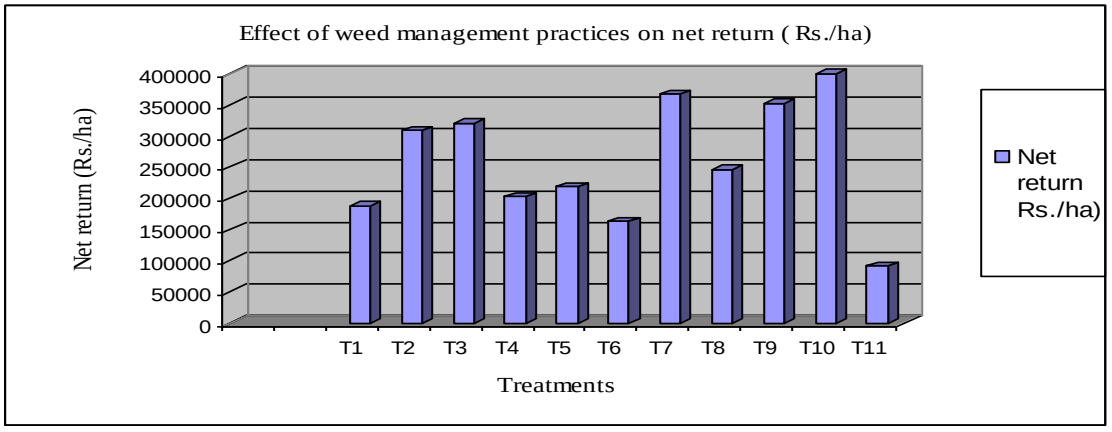
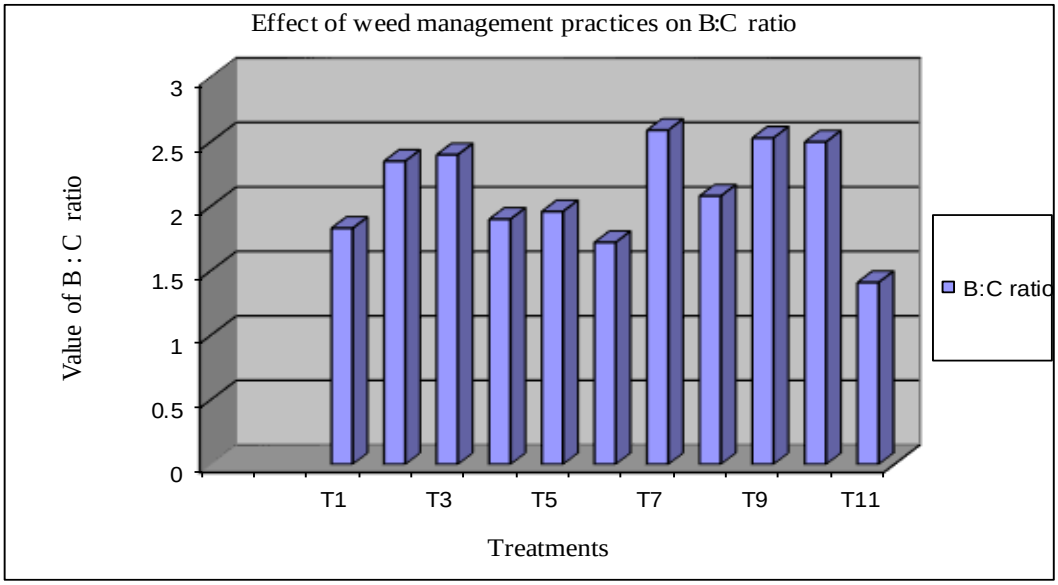


Fig.4



Significantly lowest tuber yield (21.1 t/ha) was recorded in control treatment than all other treatments which may be due to maximum competition offered by weeds to the plants of elephant foot yam. The increase in yield varied from 31.28 to 110.43 per cent over control with the maximum in T_{10} followed by T_7 (88.63 per cent). Net return was also significantly influenced by different weed management practices. Significantly highest net return (Rs.399237/ha) was recorded by T_{10} than all other treatments except T_7 (Rs. 366807/ha) may be because of equally good yield realized in T_7 and lower cost of cultivation incurred as compared to $T_{10.}$ The increase in net return varied from 77.85 to 336.39 per cent over control with the maximum in

T_{10} followed by T_7 (300.94 per cent). Significantly lowest net return (Rs. 91487/ha) was recorded in control treatment than all other treatments which may be due to realization of lowest tuber yield. Different weed management practices influenced B: C ratio significantly, too and it didn't followed similar trend as that of tuber yield and net return. Significant highest B: C ratio (2.59) was recorded under T_7 which was significantly superior than the other treatments may be due to realization of equally good yield, net return and comparatively lower cost of cultivation incurred upon. B: C ratio (1.41) obtained in control treatment was significantly lowest which may be due to the lowest tuber yield, net return and comparable cost of cultivation involved.

Based on the findings of this experiment conducted for three consecutive years and the present scenario of high wages of labourers and also its scarcity particularly during peak periods and drudgery it seems to be imperative to go for chemical weed control due to its edge over manual weeding to overcome these problems. Hence, combination of herbicides (Pendimethalin @ 1.0 kg /ha as pre-emergence + Quizalofop-p-ethyl @ 75 g /ha as post-emergence) can be suggested to farmers for effective weed management in elephant foot yam particularly were grassy weeds are predominant.

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