Plant Archives Vol. 20, Supplement 2, 2020 pp. 1242-1245 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EFFECT OF INTEGRATED WEED MANAGEMENT PRACTICES ON WEED DYNAMICS, GROWTH, YIELD AND ECONOMICS OF ELEPHANT FOOT YAM [*AMORPHOPHALLUS PAEONIIFOLIUS* (DENNST.) NICOLSON]

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Abstract

An experiment was conducted to find out most suitable weed management practices for weed management in elephant foot yam during the year 2017-18 at Agricultural Research Farm, Dholi of Tirhut College of Agriculture under Dr. Rajendra Prasad Central Agricultural University, Pusa (Bihar) in sandy loam soil in randomized block design having eight treatments [T_1-Pre-emergence herbicide + Post emergence herbicide at 45 and 90 DAP, T_2-Pre emergence herbicide + hand weeding 45 and 90 DAP, T_3-Raising green manure cow pea in interspaces along with planting and incorporation 45-60 DAP + post emergence herbicide 90 DAP, T_4-Hand weeding 45 DAP + post emergence herbicide at 90 DAP,T_5-Post emergence herbicide at 30, 60 and 90 DAP, T_6-Weed control by ground cover, T_7-Hand weeding at 30, 60 and 90 DAP, T_8-Control (No weeding)] with three replications. It was found that plant height (71.4 cm), pseudo stem girth (18.6 cm) and canopy spread (102.3 cm) after five months planting was significantly higher in T_7 than T_8, T_5, T_1 and T_4 but was found at par with T_6, T_3 and T_2. The extent of increase was to the tune of 1.56 to 25.24 in plant height, 1.64 to 26.53 in pseudo stem girth and 3.86 to 20.64 per cent in canopy spread. Reduction in weed density at 40, 70 and 100 days after planting ranged from 3.71 to 86.20, 82.33 to 90.13 and 79.34 to 90.73 per cent, respectively and to that of weed dry weights/weed control efficiencies varied between 5.33 to 91.79, 86.18 to 98.03 and 79.96 to 98.77 per cent, respectively. Although excellent weed control was seen by the application of post emergence of glyphosate but it had some toxic effect on crop plant also which ultimately reflected in less growth of crop plants and less yield and less net income to the farmers (Table 1).

Increase in corm yield, net return and B : C ratio as compared to weedy check was to the tune of 8.83 to 146.24, 11.27 to 906.95 and 3.28 to 115.38 per cent, respectively. Significant lowest weed population and weed dry weight at 40, 70 and 100 days after planting were recorded under T_7may be due to weed control right from early stage up to the maximum canopy spread stage that could kept the competition for growth resources to the minimum by weeds and ultimately resulted in realization of significant higher corm yield (41.54 t/ha), net return (Rs. 450521/ha) and B : C ratio (2.52) than T_8, T_1, T_4 and T_5 but T_6 (weed control by ground cover) was found equally good to T_7 in terms of growth parameters, corm yield, net return and B : C ratio which may be due to moisture conservation for the plants during the hot months, keeping the temperature congenial for early sprout of seed corm, adding nutrients after decomposition, enhancing microbial activities in the rhizosphere, keeping weeds in control from the starting stage up to stage of maximum canopy spread etc.

Keywords : Elephant foot yam, weed management, weed dynamics, herbicides, corm yield, net return.

Introduction

Elephant Foot Yam [*Amorphophallus paeoniifolious* (Dennst.) Nicolson)] is one of the most important tuber crops of India as well as of the world. It is also an important tuber crop grown in Bihar particularly in the districts of northern Bihar. In the present scenario of changing climate scenario, it has assumed more importance than before due to some unparalleled edges over other crops like- its capacity to produce even in adverse climatic conditions without affecting much on its productivity and its high yield potential. Its farming is also eco-friendly because of less use of agro-chemicals (Singh *et al*., 2019). 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 mind, 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 of 2018-19. 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 (201.8 kg/ha), phosphorus (16.0 kg/ha), and potassium (131.1 kg/ha). There were eight treatments i.e., T_1-Pre-emergence herbicide + Post emergence herbicide at 45 and 90 DAP, T_2-Pre emergence herbicide + hand weeding 45 and 90 DAP, T_3-Raising green manure cow pea in interspaces along with planting and incorporation 45-60 DAP + post emergence herbicide 90 DAP, T_4-Hand weeding 45 DAP + post emergence herbicide at 90 DAP,T_5-Post emergence herbicide at 30, 60 and 90 DAP, T_6-Weed control by ground cover, T_7-Hand weeding at 30, 60 and 90 DAP, T_8-Control (No weeding).'Gajendra' was taken as test variety. Tubers of about 500 g size was planted at a spacing of 90 cm x 90 cm. Recommended dose of manures and

fertilizers i.e., 15.0 t/ha of compost/FYM with 60: 80: 60 kg N: P_2O_5: K_2O /ha were applied uniformly in all the treatments.

Herbicides used as pre and post emergence were-pendimethalin @1000 g a.i./ha) and glyphosate @1000 g a.i./ha), respectively. A brief description about chemical structure, name and mode of action of these two herbicides is being given to understand their mode of action of on weeds-

Pendimethalin ($C_{13}H_{19}N_3O_4$)

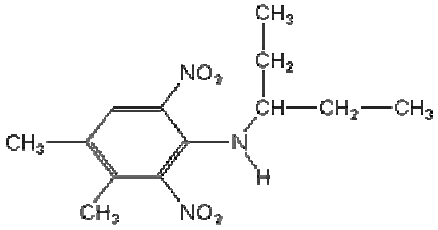
Chemical name : (N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine) Pendimethalin was discovered in 1971 by American Cyanamid Company. It is applied *as pre-or early post-emergence @ 0.50-2.0 kg/ha. Pendimethalin controls weed by inhibiting seed germination and seedling development. Pendimethalin inhibits root and shoot growth. It's primarily mode of action is to prevent plants cell division and elongation in susceptible species.

Glyphosate ($C_3H_8NO_5P$)

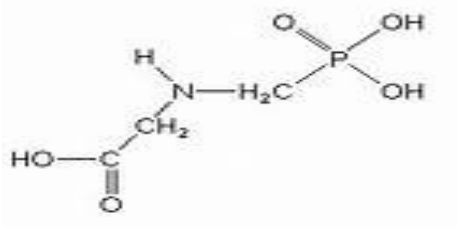
Chemical name : (3-amino-2-oxopropyl) dihydrogen phosphate

Glyphosate is one of the most widely used herbicides with applications in agriculture, forestry, industrial weed control, lawn, garden, and aquatic environments. In plants, glyphosate disrupts the shikimic acid pathway through inhibition of the enzyme 5-enolpyruvylshikimate-3-phosphate (EPSP) synthase. The resulting deficiency in EPSP production leads to reductions in aromatic amino acids that are vital for protein synthesis and plant growth. Glyphosate is absorbed across the leaves and stems of plants and is translocated throughout the plant. It concentrates in the meristem tissue. Plants exposed to glyphosate display stunted growth, loss of green coloration, leaf wrinkling or malformation, and tissue death. Death of the plant may take from 4 to 20 days to occur.

The experiment was laid out in randomized block design with three replications. Weed samples were taken randomly at 40, 70 and 100 days after planting from three places using a quadrate of 0.25 m^2 and converted into weed population/ m^2.



PENDIMETHALIN



GLYPHOSATE

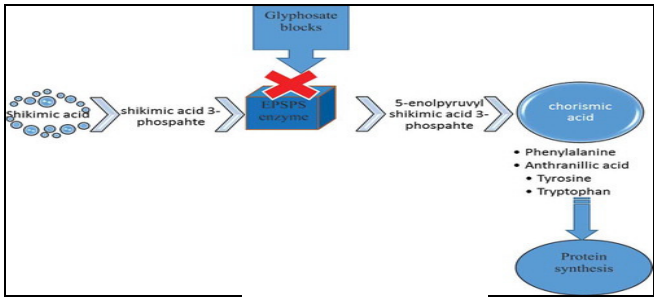


Fig.1 : Heap I, Duke SO. 2017

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, Digera arvensis, Physallis minima, Cannabis sativa, Euphorbia spp, Parthenium hysterophorus, Amaranthes spp.,Cleome viscosa, Leucas aspera etc.* Tubers/corms 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. Standard package of practices were followed and analysis was done following standard statistical procedures.

Results and Discussion

Different treatments of herbicides alone or in combination with other herbicides or with hand weeding, weed control by ground cover, hand weeding thrice (30, 60 and 90 DAS) and one control treatment produced significant effect on plant height, pseudo stem girth, canopy spread, weed population, weed dry weight, weed index (%), tuber/corm yield, net return and B: C ratio of elephant foot yam (Table 1.).

Plant height recorded at 3 MAP was found significantly highest (58.8 cm) in T7 than T8, T5, T1, T4 and T2 and was closely followed by T6 and T3 and the same recorded at 5 MAP followed the same trend except T2 may be due to less competition by weed for the above and below ground growth factors (moisture, nutrients, light, space etc.). The extent of increase in plant height was to the tune of 1.56 to 25.24 per cent with respect to control (weedy check) treatment. Pseudo stem girth recorded at 3 and 5 MAP showed almost the similar trend as that of plant height but canopy spread recorded under T7 was found significantly superior tan all other treatments except T6 at 3 MAP and T6 & T3 at 5 MAP and the extent of increase were 1.64 to 26.53 in pseudo stem girth and 3.86 to 20.64 per cent in canopy spread. Significant lowest values of weed population recorded at 40 DAP were found in T7,T6, T5 and T3 due to hand weeding at 30 DAP, application of glyphosate at 30 DAP, ground cover or raising green manuring crop.

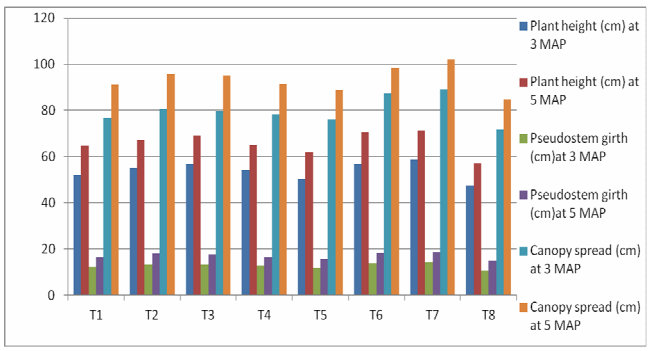


Fig. 2 : Effect of integrated weed management practices on plant height, pseudo stem girth and canopy spread.

Similar observations of weed population were also seen at 100 DAP except in T6 where no weeding or herbicide application was done. Dry weights of weeds recorded at 40 and 100 DAP followed almost similar trend. Significant highest weed population and dry weight of weeds taken at 40 and 100 DAP were recorded in weedy check since no weed management practices were done there. Maximum weed control efficiency was seen in treatments where glyphosate was applied or hand weeding were done but the lowest weed control efficiency was recorded in T4 where no weed management practices was done before 40 DAP. Reduction in weed density at 40 and 100 days after planting ranged from 3.71 to 86.20, and 79.34 to 90.73 per cent, respectively and to that of weed dry weights and weed control efficiencies varied between 5.33 to 91.79, and 79.96 to 98.77 per cent, respectively due to different weed management practices. Weed index calculated in T6 was found lowest which was followed by T2 and T3. Highest weed index was estimated in control treatment due to lowest corm yield realized which may be due to the highest competition for growth factors offered by weeds in control treatment as compared to other treatments.

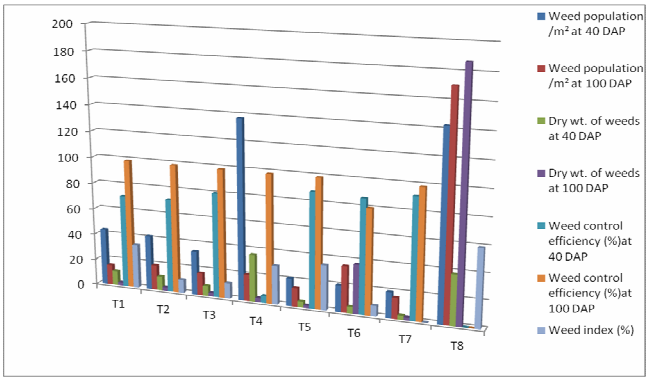


Fig. 3 : Effect of integrated weed management practices on weed population, weed dry wt. and weed control efficiency.

Significantly lowest tuber yield (16.87 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 due to different weed management practices over control varied from 8.83 to 146.24 per cent with the maximum in T7 followed by T6 (126.26 per cent). Net return was also significantly influenced by different weed management practices. Significantly highest net return (Rs.450521/ha) was recorded by T7 than all other treatments except T6 (Rs. 404901/ha) and T2 (Rs. 387041/ha) may be because of equally good yield realized particularly in T6 and lower cost of cultivation incurred as compared to T7. The increase in net return varied from 11.27 to 906.95 per cent over control with the maximum in T7 followed by T6 (762.08 per cent). Significantly lowest net return (Rs. 44741/ha) was recorded in control treatment than all other treatments which may be due to realization of lowest tuber yield due to heavy competition for nutrients, moisture, light and space by weeds. Different weed management practices influenced B: C ratio significantly, too and it followed similar trend as that of tuber yield and net return. Significant highest B: C ratio (2.52) was recorded under T7 which was significantly superior than the other treatments may be due to realization of highest yield and net return but was found at par with T6 and T3 for net return and T6, T3 and T2 for B : C ratio. Significantly lowest tuber yield, net return and B : C ratio were obtained under control treatment.

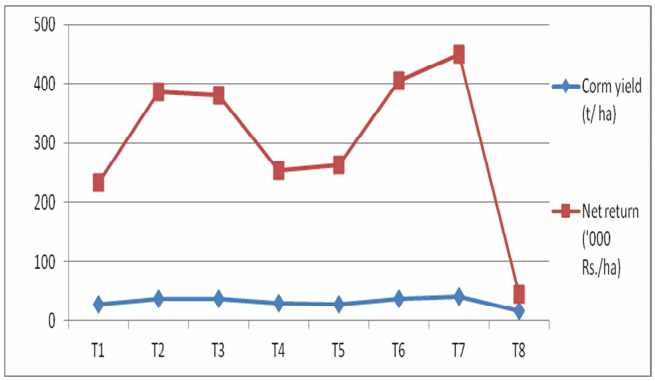


Fig. 4 : Effect of integrated weed management practices on corm yield and net return.

Based on the findings of this experiment it can be concluded that weed management by hand weeding thrice or weed management by ground cover is equally good for good yield, net return net income per rupee invested.

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

Treat-ments	Total weed population /m² at		Total dry weight of weeds (g/m²) at		Weed control efficiency (%) at		Weed index (%)	Plant height (cm)		Pseudo stem girth (cm)		Canopy spread (cm)		Corm yield (t/ ha)	Net return (Rs./ha)	B:C ratio
	40 DAP	100 DAP	40 DAP	100 DAP	40 DAP	100 DAP		3 MAP	5 MAP	3 MAP	5 MAP	3 MAP	5 MAP			
T_1	43.33	15.3	11.04	2.06	71.1	98.90	33.6	51.9	64.8	12.2	16.4	76.8	91.1	27.57	232673	1.88
T_2	41.67	19.1	10.79	2.77	71.8	98.52	10.2	55.3	67.2	13.3	17.9	80.6	95.9	37.29	387041	2.36
T_3	33.6	17.2	7.65	2.61	80.0	98.60	11.9	56.9	69.2	13.1	17.6	79.6	95.2	36.59	380353	2.37
T_4	137.5	20.3	36.22	3.04	5.3	98.37	29.5	54.2	65.1	12.9	16.4	78.5	91.4	29.29	253907	1.93
T_5	21.3	14.3	4.57	2.01	88.1	98.92	34.3	50.4	61.9	11.8	15.7	76.1	88.8	27.30	262919	1.86
T_6	20.4	35.2	5.06	37.42	86.8	79.96	8.1	56.7	70.3	13.9	18.3	87.3	98.5	38.17	404901	2.44
T_7	19.7	15.8	3.14	2.29	91.8	98.77		58.8	71.4	14.1	18.6	89.2	102.3	41.54	450521	2.52
T_8	142.8	170.4	38.26	186.74			59.4	47.4	57.01	10.6	14.7	71.8	84.8	16.87	44741	1.17
CD (p=0.05)	14.94	6.28	3.80	4.73				5.23	5.49	2.00	2.02	6.88	7.13	4.86	63939	0.23

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