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## COMPARATIVE ASSESSMENT OF WEED CONTROL STRATEGIES ON WEED DENSITY AND BIOMASS IN ELEPHANT FOOT YAM (*AMORPHOPHALLUS PAEONIIFOLIUS* DENNST. NICOLSON) CV. GAJENDRA

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### ABSTRACT

A field experiment was conducted from June 2017 to February 2018 at the experimental site of All India Coordinated Research Project (AICRP) on Tuber Crops, under the Department of Horticulture, Birsa Agricultural University, Kanke, Ranchi, Jharkhand, to evaluate the efficacy of different weed management practices on weed density, dry matter accumulation and weed control efficiency in elephant foot yam [*Amorphophallus paeoniifolius* (Dennst.) Nicolson] cv. Gajendra. The trial was arranged as a randomized block design with nine weed control treatments that included chemical, mechanical, cultural and integrated weed management practices. Each treatment was replicated three times. The experimental field was infested with grasses, broad-leaved weeds and sedges belonging to nine botanical families, with broad-leaved weeds as the dominant group. Weed density increased up to 120 days after planting (DAP) and declined thereafter irrespective of treatments. All weed management treatments significantly reduced weed density and dry matter accumulation at 90, 120, and 150 DAP compared with the weedy check. Black plastic mulch (T<sub>7</sub>) recorded complete weed suppression at 90 and 120 DAP and maintained the lowest weed density and biomass throughout the crop growth period, followed by hand weeding at 30, 60, and 90 DAP (T<sub>8</sub>). Among chemical and integrated treatments, pre-emergence application of pendimethalin followed by glyphosate, and intercropping cowpea as green manure with subsequent glyphosate application, were effective in suppressing weed population and biomass. Weed control efficiency ranged from 30.95% to 100% across growth stages, with black plastic mulch (T<sub>7</sub>) consistently recording the highest values followed by hand weeding at 30, 60, and 90 DAP (T<sub>8</sub>). The study concludes that black plastic mulch and integrated weed management approaches provide superior and sustainable weed suppression compared to sole chemical control, and can be effectively adopted by farmer cultivating elephant foot yam under eastern plateau and hill conditions.

**Keywords :** Black plastic mulch, Integrated weed management, Weed control efficiency, Weed density, Weed dry matter.

### Introduction

Tuber crops are the second group of cultivated species, after cereals, and grown throughout the world in hot and humid regions (Paulino and Yeung, 1981; Latha *et al.*, 2004). Among the tuberous crops, Elephant foot yam [*Amorphophallus paeoniifolius* (Dennst.) Nicolson] is one of the important tropical tuber crops widely grown in India for its high productivity, wide range of nutritional value and high

demand in the pharmaceutical sector. Elephant foot yam is a highly nutritive vegetable (Gopalan *et al.*, 1999). A One hundred grams fresh weight of tuber of elephant foot yam contains high starch content (11-28 percent), sugar (0.7-1.7 percent), vitamin C (17.1 mg), calcium (161.08 mg), and micronutrients like iron (3.43 mg), manganese (0.19-0.65 mg), zinc (0.12-1.92 mg) and other minerals in sufficient amount (Singh and Wadhwa, 2014). Apart from this, the crop serves as an

important source of carbohydrates and holds a prime position in food security and farmers' incomes, particularly in tropical regions. This crop is cultivated in approximately 40,000 ha with a production of 1.0 million metric tonnes in India (NHB 2022).

It has been well established that the yield loss due to weeds is quite higher (45%) than the pests (30%) and diseases (20%) (Nedunchezhiyan *et al.*, 2018). Weed infestation is one of the major biotic constraints in elephant foot yam cultivation due to its wider plant spacing and long growth periods and weeds compete with the crop for essential resources like nutrients, moisture, light and space. Weeds often germinate and grow earlier than elephant foot yam because of slow sprouting of corm setts (Nedunchezhiyan *et al.*, 2018). Weeds also provide a reservoir for many harmful agents that cause pests and diseases (Kumar *et al.*, 2020). During the initial phase, elephant foot yam shows slow growth and this allows weeds to proliferate and dominate the crop environment during the critical growth period, consequently reduced crop vigour and yield potential.

Proper oversight is vital to achieve a good elephant-foot yam cultivation. Although manual weeding is traditionally practiced and provides satisfactory weed control, it is labour-intensive and increases the cost of cultivation due to rising labour scarcity (Singh *et al.*, 2017). Weeding alone requires more than 30% of the total labour in this crop and it is approximately 150-200 mandays/ha (Nedunchezhiyan *et al.*, 2018). Chemical weed control and integrated weed management approaches have emerged as efficient alternatives, offering improved weed suppression with reduced labour requirements and better economic returns. Limited research has examined how weed control methods influence weed density and dry-matter accumulation in elephant-foot yam. This study assessed various control techniques to determine their effects on weed numbers and biomass.

### Materials and Methods

A field trial was carried out at the experimental site of All India Coordinated Research Project (AICRP) on tuber crops under the Department of Horticulture, Birsa Agricultural University, Kanke, Ranchi, Jharkhand (23°26'31"N, 85°19'02" E, 651 m above mean sea level). The location falls within Agro-climatic Region VII (eastern plateau and hills) and experiences a sub-humid climate with hot summers and cold winters. Annual rainfall averages 1,326mm (based on an 80-year average) with about 85% occurring from June to September. The plots had well-drained sandy loam soil of good fertility, level

surface, and a pH of 5.25. The study conducted from June 2017 to February 2018 and laid out in a randomized block design with nine treatments, each replicated three times. The treatment details are as under T<sub>1</sub> (Pendimethalin 1 kg a.i. ha<sup>-1</sup> at 1 DAP + glyphosate 1 kg a.i. ha<sup>-1</sup> at 45 and 90 DAP), T<sub>2</sub> (Pendimethalin 1 kg a.i. ha<sup>-1</sup> at 1 DAP + two hand weeding 45 and 90 DAP), T<sub>3</sub> (Raising green manure cow pea in interspaces along with planting and incorporation 45-60 DAP + glyphosate 1 kg a.i. ha<sup>-1</sup> 90 DAP), T<sub>4</sub> (Hand weeding 45 DAP + glyphosate 1 kg a.i. ha<sup>-1</sup> at 90 DAP), T<sub>5</sub> (Glyphosate 1 kg a.i. ha<sup>-1</sup> at 30, 60 and 90 DAP), T<sub>6</sub> (Weed control ground cover with cowpea), T<sub>7</sub> (Black plastic mulch), T<sub>8</sub> (Hand weeding at 30, 60 and 90 DAP) and T<sub>9</sub> {Control (No weeding)}.

The study was conducted using the elephant foot yam (*Amorphophallus paeoniifolius* Dennst.) cultivar 'Gajendra'. Experimental plots measuring 3 m × 3 m were laid out with a planting spacing of 60 cm × 60 cm. All other crop management practices were followed as per ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram, Kerala PoP (Package of Practices) (Mohan *et al.* 2000) except weed management practices to raise the crop. Uniform and healthy corms weighing approximately 500 g and possessing well-developed buds were selected for planting. Manual planting was carried out, with 25 corms per plot. Prior to planting, corm pieces retaining the central bud were treated one day prior to planting with a slurry prepared from fresh cow dung (10 kg in 10 L of water) mixed with 50 g of fungicide. Pendimethalin was applied as a pre-emergence herbicide one day after planting, and adequate soil moisture was maintained to ensure optimal herbicidal efficacy. Glyphosate was applied as a post-emergence herbicide as a directed spray to weeds according to the prescribed treatment schedule. All herbicide applications were performed using hand-operated sprayers at a spray volume of 500 L ha<sup>-1</sup>, and separate sprayers were used for each treatment to prevent cross-contamination. Details of herbicide application mentioned in Table 1 : The required quantity of herbicides was calculated by using the following formula

$$\text{Commercial product (kg ha}^{-1}\text{)} = \frac{(\text{dose in kg a.i. ha}^{-1} * 100)}{\% \text{ a.i. in the product}}$$

Where, a.i.= active ingredient; ha= hectare

Manual weed control was undertaken as per the treatment requirements, and weeds were removed by hand. Cowpea was grown as a green manure crop in the inter-row and was incorporated into the soil at 60 days after planting (DAP). Black polyethylene mulch

was applied at 15 DAP at a rate of 185 kg ha<sup>-1</sup> (approximately 8,000 m<sup>2</sup> ha<sup>-1</sup>), ensuring that emerging shoots were not obstructed. Throughout the crop growth period, uniform and need-based plant protection measures were adopted for the effective management of insect pests and diseases. Weed assessments were conducted in each plot at 90, 120, and 150 days after planting. A 0.25 m<sup>2</sup> rectangular iron quadrat was placed at two random locations within each plot, and all weeds inside the quadrat were counted. The weeds were then categorized as narrow-leaf, broad-leaf, and sedge. Weed samples collected at the same three time points were first sun-dried to remove surface moisture and then oven-dried at 60°C±5°C. After drying, the weight of

each sample was recorded on an electronic balance and expressed as gm<sup>-2</sup>.

Weed density (plants m<sup>-2</sup>) and dry-matter data were calculated and transformed using  $\sqrt{(X+0.5)}$  before statistical analysis as suggested by Bartlett (1947).

The weed control efficiency (WCE) was calculated by the following formula suggested by Mani *et al.* (1973) and expressed in percentage. WCE (%) = [(DWC-DWT)/DWC]\*100 Where, DWC Dry weight of weeds in weedy check plot (g m<sup>-2</sup>); DMT= Dry weight of weeds in treated plot (g m<sup>-2</sup>). The data were analysed by adopting the method of analysis of variance (ANOVA) as described by Gomez and Gomez (1984).

**Table 1:** Detail of herbicides application

S. No.	Common name	Trade name	a.i. (%)	Chemical name	Dose ha <sup>-1</sup>	Formulation ha <sup>-1</sup>
01.	Pendimethalin	Spirit	30 E.C.	[N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine]	1.0 kg	3.3 kg
02.	Glyphosate	Roundup	41 E.C.	N (phosphonomethyl) Glycine	1.0 kg	2.43 lit

**Table 2:** Weed species observed in experimental site during the Study

Scientific name	Common name	Family
<b>Broad-leaved weed</b>		
<i>Commelina benghalensis</i> (L.)	Day flower	Commelinaceae
<i>Alternanthera sessilis</i>	Alligator weed	Amaranthaceae
<i>Ageratum conyzoides</i> (L.)	Billgoat weed	Asteraceae
<i>Euphorbia hirta</i> (L.)	Spurge	Euphorbiaceae
<i>Spilanthes acmella</i>	Toothache plant	Asteraceae
<i>Stellaria media</i> (L.)	Chick weed	Caryophyllaceae
<i>Vernonia cinerea</i>	Ironweed	Asteraceae
<i>Tridax procumbens</i>	Coatbuttons or Tridax daisy	Asteraceae
<i>Mollugo disticha</i>	Green carpetweed	Molluginaceae
<i>Physalis minima</i>	Rasbhari	Solanaceae
<i>Synederella nodiflora</i>	Nodeweeds	Asteraceae
<b>Narrow-leaved weed</b>		
<i>Cenchrus ciliaris</i>	Daman grass, Anjan grass	Poaceae
<i>Eleusine indica</i>	Yard grass, Goose grass	Poaceae
<i>Cyanotis axillaris</i>	Creeping Cradle Plant	Commelinaceae
<i>Cynodon dactylon</i>	Bermuda grass, Dhoob	Poaceae
<b>Sedges</b>		
<i>Cyperus rotundus</i> (L.)	Purple nut sedge	Cyperaceae

## Results and Discussion

### Weed flora

The weed flora of the experimental plot comprised grasses, broad-leaved weeds and sedges belonging to nine botanical families, namely Amaranthaceae, Asteraceae, Euphorbiaceae, Capparaceae, Cyperaceae, Caryophyllaceae, Commelinaceae, Poaceae, Molluginaceae and

Solanaceae (Table 2). The predominance of weed species belonging to the families Asteraceae and Poaceae observed in the present study is in conformity with earlier findings in cassava and other tuber crops (Costa *et al.*, 2013; Soares *et al.*, 2016). Broad-leaved weeds constituted the major proportion of the weed flora, followed by grasses and sedges similar findings were reported by Kumar *et al.* (2020, 2023).

The dominant grassy weeds were *Cenchrus ciliaris*, *Eleusine indica*, *Cyanotis axillaris* and *Cynodon dactylon*. Important broad-leaved weed species included *Commelina benghalensis*, *Alternanthera sessilis*, *Ageratum conyzoides*, *Euphorbia hirta*, *Spilanthus acmella*, *Stellaria media*, *Vernonia cinerea*, *Tridax procumbens*, *Physalis minima*, *Synedrella nodiflora* and *Mollugo disticha*, while *Cyperus rotundus* was the principal sedge infesting the field. A comparable weed flora composition has been reported earlier in elephant foot yam, cassava and potato by Bhaumik *et al.* (1988), Mukherjee *et al.* (2012), Sekhar *et al.* (2017), Velmurugan *et al.* (2017) and Kumar *et al.* (2020, 2023)

### Weed density and dry matter accumulation

The weed control treatments brought about significant variation in total weed control and all the treatments were significantly superior to weedy check in reducing weed density (Kumar *et al.*, 2019, Nedunchezhiyan *et al.*, 2013 and 2018), data are summarized in Table 3, 4 & 5. Total weed density exhibited an increasing trend up to 120 days after planting (DAP) and declined thereafter at 150 DAP. This trend may be attributed to variations in the emergence behaviour and life span of different weed species. Broad-leaved weeds emerged earlier and completed their life cycle sooner than grassy and sedge weeds.

Among the weed management treatments, black plastic mulch (T<sub>7</sub>) resulted in complete suppression of all categories of weeds at 90 DAP (0.00 m<sup>-2</sup>), followed by hand weeding at 30, 60 and 90 DAP (T<sub>8</sub>). A similar trend was observed at 120 DAP. However, a marginal increase in weed density under black plastic mulch (T<sub>7</sub>) was noticed at 150 DAP, which might be due to the emergence of late-growing weeds through planting holes. Similar effects of black plastic mulch have been reported by Sekhar *et al.* (2017), Nedunchezhiyan *et al.*

(2017), Nedunchezhiyan *et al.* (2018), Kumar *et al.* (2020a) and Kumar *et al.* (2020b), Kamalkumaran *et al.* (2024) in elephant foot yam and in Cassava Suja *et al.* (2021), Imamsaheb *et al.* (2024) and Imamsaheb *et al.* (2025).

Among the chemical and integrated approaches, sequential application of glyphosate (T<sub>5</sub>) significantly reduced the density of all kinds of weeds compared with the weedy check throughout the crop growth period. Application of pendimethalin at planting followed by hand weeding (T<sub>2</sub>) proved more effective against broad-leaved weeds at 120 DAP, while integration of green manure cowpea with glyphosate (T<sub>3</sub>) showed superior weed suppression at the later growth stage. A marked reduction in sedge population was observed under successive spray of Glyphosate 1 kg a.i. ha<sup>-1</sup> at 30, 60 and 90 DAP (T<sub>5</sub>). Effective weed control during the critical crop–weed competition period resulted in lower weed density, which is in agreement with the findings of Sekhar *et al.* (2017) and Velmurugan *et al.* (2017).

Weed dry matter accumulation followed trends similar to those of weed density, data are summarized in Table 3, 4 & 5. Black plastic mulch (T<sub>7</sub>) recorded the minimum weed biomass at 90 and 120 DAP, followed by hand weeding (T<sub>8</sub>). At 150 DAP, a slight increase in weed dry matter was recorded under plastic mulch. The weedy check consistently recorded significantly higher weed dry matter at all stages of crop growth. Reduced weed biomass under mulching may be attributed to limited light penetration and inhibition of photosynthetic activity beneath the mulch, corroborating the observations of Goswami and Saha (2006) and Reshma *et al.* (2016), Sekhar *et al.* (2017), Nedunchezhiyan *et al.* (2017), Nedunchezhiyan *et al.* (2018), Kumar *et al.* (2020a) and Kumar *et al.* (2020b), Kamalkumaran *et al.* (2024) in elephant foot yam and in cassava Suja *et al.* (2021), Imamsaheb *et al.* (2024) and Imamsaheb *et al.* (2025).

**Table 3:** Narrow, Broad and Sedges leaved weed Density (no. m<sup>-2</sup>) in elephant foot yam as influenced by different integrated weed management treatments

Treatments details	Narrow leaved weed (no. m <sup>-2</sup> )			Broad-leaved weed (no. m <sup>-2</sup> )			Sedges leaved weed (no. m <sup>-2</sup> )		
	90 DAP	120 DAP	150 DAP	90 DAP	120 DAP	150 DAP	90 DAP	120 DAP	150 DAP
T <sub>1</sub> - Pendimethalin 1 kg a.i. ha <sup>-1</sup> at 1DAP + glyphosate 1 kg a.i. ha <sup>-1</sup> at 45 and 90 DAP	17.36 (277.33)	14.11 (179.67)	17.99 (298.67)	19.47 (352.00)	18.45 (314.67)	17.52 (282.67)	10.23 (90.67)	12.71 (144.00)	12.25 (133.33)
T <sub>2</sub> - Pendimethalin 1 kg a.i. ha <sup>-1</sup> at 1 DAP + two hand weeding 45 and 90 DAP	16.87 (261.33)	17.36 (277.33)	16.87 (261.33)	18.89 (330.67)	15.13 (208.00)	16.87 (261.33)	9.03 (69.33)	11.54 (117.33)	12.02 (128.00)
T <sub>3</sub> - Raising green manure cow pea in interspaces along with planting and incorporation 45-60 DAP + glyphosate 1 kg a.i. ha <sup>-1</sup> 90 DAP	20.03 (373.33)	15.31 (213.33)	15.49 (218.67)	22.62 (480.00)	15.85 (229.33)	16.37 (245.33)	10.23 (90.67)	11.54 (117.33)	5.87 (26.67)
T <sub>4</sub> - Hand weeding 45 DAP + glyphosate 1	19.75	14.37	11.29	23.45	22.00	19.61	11.54	9.03	12.25

kg a.i. ha <sup>-1</sup> at 90 DAP	(362.67)	(186.67)	(112.0)	(517.33)	(453.33)	(357.33)	(117.33)	(69.33)	(133.33)
T <sub>5</sub> - Glyphosate 1 kg a.i. ha <sup>-1</sup> at 30, 60 and 90 DAP	11.54 (117.33)	13.77 (170.67)	9.35 (74.67)	18.14 (304.00)	16.87 (261.33)	17.36 (277.33)	8.37 (58.67)	0.71 (0.00)	11.54 (117.33)
T <sub>6</sub> - Weed control ground cover with cowpea	22.86 (490.67)	14.75 (197.33)	17.36 (277.33)	26.53 (666.67)	26.11 (645.33)	24.14 (549.33)	12.25 (133.33)	9.03 (69.33)	14.94 (202.67)
T <sub>7</sub> - Black plastic mulch	0.71 (0.00)	0.71 (0.00)	3.97 (10.67)	0.71 (0.00)	0.71 (0.00)	3.02 (5.33)	0.71 (0.00)	0.71 (0.00)	3.97 (10.67)
T <sub>8</sub> - Hand weeding at 30, 60 and 90 DAP	8.01 (53.33)	14.17 (181.33)	12.71 (144.00)	6.82 (37.33)	7.24 (42.67)	7.64 (48.00)	7.24 (42.67)	6.82 (37.33)	4.71 (16.00)
T <sub>9</sub> - Control (No weeding)	24.82 (581.33)	25.69 (624.00)	21.87 (448.00)	30.99 (917.33)	28.80 (789.33)	29.46 (826.67)	14.75 (197.33)	19.47 (352.00)	17.36 (277.33)
SEm±	0.91	0.94	0.84	0.90	1.27	0.77	0.51	0.61	0.57
CD (P=0.05)	2.74	2.82	2.50	2.71	3.80	2.31	1.53	1.82	1.70
CV (%)	10.08	11.31	10.39	8.42	13.14	7.97	9.44	11.65	9.39

**Note:** Data in parenthesis (original value) was subjected to  $\sqrt{X+0.5}$  transformation

**Table 4:** Dry matter accumulation by narrow, broad and Sedges leaved weed (g m<sup>-2</sup>) in elephant foot yam as influenced by different integrated weed management treatments

Treatments details	Dry matter of narrow leaved weed (g m <sup>-2</sup> )			Dry matter of broad-leaved weed (g m <sup>-2</sup> )			Dry matter of sedges leaved weed (g m <sup>-2</sup> )		
	90 DAP	120 DAP	150 DAP	90 DAP	120 DAP	150 DAP	90 DAP	120 DAP	150 DAP
T <sub>1</sub> - Pendimethalin 1 kg a.i. ha <sup>-1</sup> at 1DAP + glyphosate 1 kg a.i. ha <sup>-1</sup> at 45 and 90 DAP	10.50 (95.93)	9.57 (78.56)	14.06 (178.41)	15.48 (218.21)	12.76 (145.23)	13.21 (156.43)	5.74 (25.32)	7.62 (47.73)	7.87 (51.32)
T <sub>2</sub> - Pendimethalin 1 kg a.i. ha <sup>-1</sup> at 1 DAP + two hand weeding 45 and 90 DAP	10.18 (89.65)	7.17 (41.73)	15.34 (214.00)	14.96 (209.03)	9.84 (83.49)	12.89 (148.32)	5.45 (22.50)	6.35 (31.85)	7.55 (46.79)
T <sub>3</sub> - Raising green manure cow pea in interspaces along with planting and incorporation 45-60 DAP + glyphosate 1 kg a.i. ha <sup>-1</sup> 90 DAP	11.78 (122.63)	9.56 (78.45)	14.28 (184.15)	12.92 (149.26)	10.34 (92.74)	11.59 (118.53)	4.37 (13.45)	7.05 (40.28)	4.75 (16.37)
T <sub>4</sub> - Hand weeding 45 DAP + glyphosate 1 kg a.i. ha <sup>-1</sup> at 90 DAP	12.81 (146.53)	8.27 (57.14)	10.39 (93.81)	15.32 (213.64)	12.23 (132.82)	13.79 (204.56)	7.30 (43.49)	4.78 (15.27)	10.18 (89.82)
T <sub>5</sub> - Glyphosate 1 kg a.i. ha <sup>-1</sup> at 30, 60 and 90 DAP	7.62 (47.84)	9.72 (81.23)	7.44 (45.31)	14.08 (178.94)	10.86 (103.09)	13.28 (158.20)	6.10 (29.05)	0.71 (0.00)	9.53 (77.84)
T <sub>6</sub> - Weed control ground cover with cowpea	14.48 (189.57)	10.28 (91.62)	14.18 (181.43)	19.00 (334.54)	20.98 (411.16)	15.79 (227.43)	9.65 (80.00)	6.35 (31.81)	10.16 (89.42)
T <sub>7</sub> - Black plastic mulch	0.71 (0.00)	0.71 (0.00)	2.78 (4.31)	0.71 (0.00)	0.71 (0.00)	2.09 (1.92)	0.71 (0.00)	0.71 (0.00)	3.41 (7.33)
T <sub>8</sub> - Hand weeding at 30, 60 and 90 DAP	4.39 (13.56)	8.55 (61.51)	10.86 (103.11)	3.98 (10.73)	5.07 (19.06)	6.29 (31.14)	3.37 (7.08)	4.61 (16.56)	4.41 (13.74)
T <sub>9</sub> - Control (No weeding)	15.08 (206.87)	18.36 (311.49)	17.99 (298.87)	24.76 (578.32)	21.36 (426.45)	22.87 (491.23)	10.18 (89.67)	15.45 (217.5)	11.82 (123.57)
SEm±	0.40	0.39	0.55	0.62	0.68	0.61	0.25	0.28	0.41
CD (P=0.05)	1.19	1.17	1.66	1.85	2.05	1.82	0.76	0.83	1.24
CV (%)	7.05	7.40	8.06	7.95	10.27	8.50	7.49	8.10	9.26

**Table 5:** Density of total weed (no. m<sup>-2</sup>), dry matter accumulation by total weed (g m<sup>-2</sup>) and Weed control efficiency (%) in elephant foot yam as influenced by different integrated weed management treatments

Treatments details	Total weed density (no. m <sup>-2</sup> )			Dry matter accumulation by total weed (g m <sup>-2</sup> )			Weed control efficiency (%)		
	90 DAP	120 DAP	150 DAP	90 DAP	120 DAP	150 DAP	90 DAP	120 DAP	150 DAP
T <sub>1</sub> - Pendimethalin 1 kg a.i. ha <sup>-1</sup> at 1DAP + glyphosate 1 kg a.i. ha <sup>-1</sup> at 45 and 90 DAP	27.54 (720.00)	25.96 (638.00)	27.44 (714.67)	19.13 (339.46)	17.18 (271.52)	20.37 (386.73)	61.20	75.77	61.02
T <sub>2</sub> - Pendimethalin 1 kg a.i. ha <sup>-1</sup> at 1 DAP + two hand weeding 45 and 90 DAP	26.42 (661.33)	25.26 (602.67)	26.22 (650.67)	18.46 (315.18)	13.24 (157.07)	20.93 (409.11)	63.97	83.56	55.22
T <sub>3</sub> - Raising green manure cow pea in interspaces along with planting and incorporation 45-60 DAP + glyphosate 1 kg a.i. ha <sup>-1</sup> 90 DAP	31.43 (944.00)	24.37 (560.00)	22.86 (490.67)	17.60 (285.34)	15.25 (211.48)	18.57 (319.05)	67.38	77.87	65.08

T <sub>4</sub> - Hand weeding 45 DAP + glyphosate 1 kg a.i. ha <sup>-1</sup> at 90 DAP	32.29 (997.33)	27.33 (709.00)	25.26 (602.67)	20.80 (403.66)	15.03 (205.23)	20.41 (388.19)	53.86	78.52	57.51
T <sub>5</sub> - Glyphosate 1 kg a.i. ha <sup>-1</sup> at 30, 60 and 90 DAP	22.62 (480.00)	21.49 (432.00)	22.37 (469.33)	16.70 (255.83)	14.28 (184.32)	17.48 (281.35)	70.76	80.71	69.21
T <sub>6</sub> - Weed control ground cover with cowpea	36.63 (1290.67)	30.91 (912.00)	32.79 (1029.33)	25.29 (604.11)	23.83 (534.59)	23.03 (498.28)	30.95	44.05	45.46
T <sub>7</sub> - Black plastic mulch	0.71 (0.00)	0.71 (0.00)	5.87 (26.67)	0.71 (0.00)	0.71 (0.00)	4.39 (13.56)	100.00	100.00	98.52
T <sub>8</sub> - Hand weeding at 30, 60 and 90 DAP	12.25 (133.33)	16.87 (261.33)	15.13 (208.00)	6.31 (31.37)	10.56 (97.13)	12.87 (147.99)	96.41	89.83	83.80
T <sub>9</sub> - Control (No weeding)	41.89 (1696.00)	42.72 (1765.33)	40.10 (1552.00)	30.29 (874.86)	31.62 (955.44)	30.93 (913.67)	0.00	0.00	0.00
SEm±	1.09	1.28	1.12	0.81	0.77	1.01	NA	NA	NA
CD (P=0.05)	3.26	3.83	3.34	2.43	2.30	3.04	NA	NA	NA
CV (%)	7.33	9.27	7.99	8.16	8.45	9.37	NA	NA	NA

### Weed control efficiency

All weed management treatments significantly enhanced weed control efficiency (WCE) over the weedy check, data are summarized in Table 5. Weed control efficiency ranged from 30.95 to 100% at 90 DAP, 44.05 to 100% at 120 DAP and 45.46 to 98.52% at 150 DAP. Black plastic mulch (T<sub>7</sub>) recorded the highest WCE at all stages (100, 100 and 98.52%, respectively) followed by hand weeding at 30, 60 and 90 DAP (T<sub>8</sub>), whereas the lowest values were observed in the weedy check.

The superior weed control efficiency under plastic mulching may be attributed to the exclusion of photosynthetically active radiation beneath the mulch layer, which restricts weed germination and growth (Teasdale and Mohler 2000). Similar observations have been reported earlier in elephant foot yam and cassava by Nedunchezhiyan *et al.* (2013), Sekhar *et al.* (2017), Velmurugan *et al.* (2017), George and Sindhu (2017), Nedunchezhiyan *et al.* (2017), Nedunchezhiyan *et al.* (2018), Kumar *et al.* (2020b), Kamalkumaran *et al.* (2024) in elephant foot yam, and in cassava Nedunchezhiyan *et al.* (2017), Imamsaheb *et al.* (2024) and Imamsaheb *et al.* (2025).

### Conclusion

Based on the findings of this study, black plastic mulching is recommended as the most effective weed management practice in elephant foot yam for achieving minimum weed density, lower weed biomass and maximum weed control efficiency. Where plastic mulching is not feasible, integrated weed management practices involving glyphosate-based sequential applications or integration of green manure cowpea with herbicide-based approaches may be adopted as effective alternatives for sustainable and efficient weed control under similar agro-ecological conditions.

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