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Mohammad Rahaman Khan
[a] Department of Agriculture and Horticultural Sciences, School of Agriculture and Food Technology, Vignan's Foundation for Science, Technology and Research, Vadlamudi, Guntur, Andhra Pradesh, India
*Mohammad Rahaman Khan, Assistant Professor, Department of Agriculture and Horticultural Sciences, School of Agriculture and Food Technology, Vignan's Foundation for Science, Technology and Research, Vadlamudi, Guntur, Andhra Pradesh, India

AL Narayanan
Professor, Department of Agronomy, Pandit Jawaharlal Nehru College of Agriculture and Research Institute Karaikal, U.T. of Puducherry, India

S Mala
Professor, Department of Agronomy, Pandit Jawaharlal Nehru College of Agriculture and Research Institute Karaikal, U.T. of Puducherry, India

L Aruna
Associate Professor, Department of Soil Science and Agricultural Chemistry, Pandit Jawaharlal Nehru College of Agriculture and Research Institute Karaikal, U.T. of Puducherry, India

Corresponding Author:
Mohammad Rahaman Khan
[a] Department of Agriculture and Horticultural Sciences, School of Agriculture and Food Technology, Vignan's Foundation for Science, Technology and Research, Vadlamudi, Guntur, Andhra Pradesh, India
*Mohammad Rahaman Khan, Assistant Professor, Department of Agriculture and Horticultural Sciences, School of Agriculture and Food Technology, Vignan's Foundation for Science, Technology and Research, Vadlamudi, Guntur, Andhra Pradesh, India

Evaluation of different integrated weed control techniques on transplanted finger millet (*Eleusine coracana* (L.) Gaertn.) in the coastal region of Karaikal

Mohammad Rahaman Khan, AL Narayanan, S Mala and L Aruna

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Abstract
A field experiment was conducted at Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal during *rabi* season 2017-18 to evaluate different integrated weed control techniques on transplanted finger millet (*Eleusine coracana* (L.) Gaertn.) in the coastal region of Karaikal. The experiment involving ten treatments which were evaluated in Randomised Block Design and replicated thrice. Eleven weed species belonging to grasses, sedges and broad leaved weeds were found to be associated with finger millet in experimental site. Among all treatments, hand weeding twice at 15 and 30 DAT (T_9) and Pendimethalin @ 750g ha^{-1}at 3 DAT + one hand weeding at 30 DAT (T_2) resulted in lowest dry weight of weeds throughout the crop growth period and also registered the lowest nutrient uptake by weeds. Integrated weed control with pre-emergence application of Pendimethalin @ 750g ha^{-1}at 3 DAT + one hand weeding at 30 DAT (T_2) registered higher values of growth and yield components which was followed by hand weeding twice at 15 and 30 DAT (T_9). It was concluded that Pendimethalin @ 750g ha^{-1-} at 3 DAT + one hand weeding at 30 DAT is the most effective weed management practice for achieving increased nutrient uptake by crop, higher grain yield and net returns through effective control of weeds in transplanted finger millet.

Keywords: Weeds, finger millet, *Eleusine coracana*, weed flora, herbicides, pendimethalin and Bispyribac sodium

Introduction

Small millets are drought hardy crops and make an important contribution to the national food basket. Small millets offer enormous advantages such as early maturity, wider adaptability, low input cost and high nutritious value of both grain and fodder. These millets constitute to be a part of subsistence agriculture. They are high in folic acid, minerals, iron, fibre and have higher vitamin levels than rice. Small millets not only have been less researched but also have received negligible developmental support (Rao, 1986) [19]. Finger millet or Ragi has the pride of place in having the highest productivity among small millets. It is the main food grain for many people, especially in dry areas of India and Sri Lanka. It is the most important small millet grown in India in an area of 1.07 Million ha with a production of 1.89 Million tonnes and a productivity of 1.48 t ha^{-1} (Bellundagi *et al*., 2016) [1]. In Tamil Nadu the area of finger millet is 1.14 lakh ha with a production of 3.08 lakh tonnes and a productivity of 2.58 t ha^{-1} (DES and MoAFW, 2021-22).

Finger millet grains are more nutritious and provide eight times more calcium, four times more minerals and two times more phosphorus per unit of grain consumed as compared to rice. Protein content of finger millet is more than that of rice with well-balanced amino acid profile. It is a good source of methionine and lysine and is also rich in important vitamins such as thiamine, riboflavin, folic acid and niacin. It is ideal food as it lowers the incidence of cardio-vascular diseases, duodenal ulcers and diabetes among population consuming millets (MSSRF, 2002). Grain is higher in protein, fat and minerals than rice, corn, or sorghum. Finger millet is also known as Ragi or locally Kezhvaragu, valued as staple food and first important crop among small millets. It contains 9.2% protein, 1.29% fat, 76.32% carbohydrate, 2.24% minerals and 3.9% ash besides vitamin A and B.

The grains are rich in phosphorus, potassium and amino acid. It is also rich source of calcium (410 mg/100 g grain) for growing children and aged people (Tomar *et al*., 2011) [24].

The critical period for crop-weed competition is initial five weeks' period from planting (Sundaresh *et al*., 1975 and Nanjappa, 1980) [23, 11]. Effective weed management is needed for accomplishment of higher yield. It warrants for timely weeding and Inter cultivation within the critical period. Although manual weeding is effective, it is time consuming and labour intensive. By the time it is practiced, the crop would have been sufficiently damaged by weed competition. So, controlling weeds by use of herbicides is receiving attention due to shortage of labour and increased labour wages. There is a considerable dearth of knowledge concerning the feasibility of chemical weed control in Ragi. There is also a demand from farmers for the selective pre or post emergence herbicides which became cheaper when compared to manual weeding for timely control of weeds in Ragi crop. However, increased consciousness about the chemical pollution of soil and water had widened the scope for an integrated approach to control weeds.

Keeping this in view, the experiment was conducted to study the weed flora and an effective integrated weed management practice for transplanted finger millet.

Materials and Methods

The present investigation entitled "Assessment of various integrated weed management practices on transplanted finger millet (*Eleusine coracana* (L.) Gaertn.) in the coastal region of Karaikal." was undertaken to know the influence of weeds in combination with various integrated weed management practices on the performance of finger millet for growth and yield characters at A22 field at Agronomy farms of PAJANCOA&RI, Karaikal during December to April, 2017-18. Karaikal is situated at 10° 55'N latitude and 79°49'E longitude with an altitude of four meters above MSL. Location comes under coastal deltaic alluvial plain zone which has a tropical climate with the mean maximum and minimum temperatures of 30.6 °C and 21.1 °C respectively. The mean annual total rainfall is 1112mm. The total annual evaporation is 438.5 mm and the annual total bright sun shine hours is 699.2. The mean annual morning and evening relative humidity are 93% and 67% respectively, while the mean annual wind speed is 5 kmph.

The experiment was laid out in a Randomized Block Design with ten treatments *viz.*T_1 (Application of Pendimethalin @ 750g ha^{-1}at 3 DAT), T_2 (T_1 + one hand weeding at 30 DAT), T_3 (T_1 + one weeding by peg type weeder at 30 DAT), T_4 (T_1 + Bispyribac sodium @ 25g ha^{-1} at 25 DAT), T_5 (Application of Bispyribac sodium @ 25g ha^{-1} at 15 DAT), T_6 (T_5 + one hand weeding at 30 DAT), T_7(T_5 + one weeding by peg type weeder at 30 DAT), T_8 (Weeding twice by peg type weeder at15 and 30 DAT), T_9 (Hand weeding twice at15 and 30 DAT) and T_{10} (Unweeded control) with three replications. The finger millet seeds of the variety TRY-1 were used with all the crop management practices pertaining to finger millet were followed as per crop production guide.

Results and Discussion

Effect of weed control treatments on weeds

Weed floristic composition

Diverse weed flora was observed in transplanted finger millet. Eleven weed species belonging to grasses, sedges and broad leaved weeds were found to be associated with finger millet in experimental site *viz.*, *Echinochloa colonum* (L), *Dactyloctenium aegyptium*, (L), *Eleusine indica* (L.), *Cynodon dactylon* (L.), *Chloris barbata* Sw. (among grasses), *Cyperus rotundus* (L) (among sedges), *Eclipta alba* (L), *Aeschynomene indica* (L), *Cleome viscosa* (L), *Corchorus trilocularis* (Auct.) and *Alysicarpus rugosus* (Willd.) DC. (among broad leaved weeds) (Table 1). Such dominance of weed species in finger millet was also reported by Dhanapal *et al.* (2015) [3] in finger millet-groundnut cropping system, Kumar *et al.* (2015) [6] and Satish.*et al.* (2018) [21] in drill sown finger millet. Among the weed flora observed in the field, grasses dominated over the sedges and broad leaved weeds with the percentage of 83 and 76 (Fig. 3). This is in line with the findings of Prasad *et al.* (2010) [24] and Dhanapal *et al.* (2015) [3].

Weed dry weight

The weed control treatments significantly showed the dry weight of all the groups of weeds throughout the crop growth period as compared to unweeded control (Fig. 2). During early stages of crop growth (30 DAT), hand weeding twice at 15 and 30 DAT (T_9) and Pendimethalin @ 750 g ha^{-1} at 3 DAT + one weeding by peg type weedier at 30 DAT (T_3) registered lowest dry weight of weeds owing to effective suppression of all groups of weeds due to reduced weed density by Pendimethalin during initial period due to effective hand weeding. Such reports were also made by Tahir *et al.* (2015) and Makhan *et al.* (2016) [8].

During later stages (60 DAT and at harvest) hand weeding twice at 15 and 30 DAT (T_9) and Pendimethalin @ 750g ha^{-1}at 3 DAT + one hand weeding at 30 DAT (T_2) resulted in lowest dry weight of weeds (Fig. 2), (Table 2). The lower weed dry weight in twice hand weeding (T_9) might be due to reduced soil seed bank as well as the poor emergence of weeds after second hand weeding. Hand weeding controlled the emerged weeds and those that emerged later on might have failed to accumulate sufficient dry matter owing to the competition offered by the crop plants. Moreover, the weed seeds under depleted soil seed bank shall have been brought to the upper soil layer by hand weeding, though germinated and emerged later they were in their initial growth stage thus accumulating less dry weight. Effective reduction in weed density by Pendimethalin during initial period and by hand weeding at later periods was the reason for lower dry weight of weeds in treatment T_2. This is in confirmation with the results of Singh *et al.* (2016) [22], Tuti *et al.* (2016) [25] and Haindavi *et al.* (2018) [5]. It was also noticed that highest weed dry weight were observed in unweeded control at all the stages; which might be due to the accumulation of higher dry matter of weeds and higher weed intensity. This resulted in dominance of weeds in utilizing the sunlight, nutrients, moisture, CO_2 *etc*. This is in corroboration with the findings of Pradhan *et al.* (2010) [14] and Rao *et al.* (2015) [20].

Nutrient uptake by weeds

Unweeded control recorded maximum uptake of nutrients (N, P and K) by weeds. This was mainly due to poor control of weeds which has facilitated the weeds to utilize nutrients to maximum extent (Table 3). Similarly, increase in nutrient uptake by increase in weed competition is also reported by Patil *et al.* (2014) [13] and Kumar *et al.* (2015) [6].

Effect of weed control treatments on finger millet

Growth components

The growth components in finger millet such as plant height, number of tillers and crop DMP were progressively increasing from 30 DAT to harvest stage. LAI showed increased trend from 30 DAT to 60 DAT but decreased at harvest stage. On comparing all the weed management practices the growth components were dominated by treatments *viz.*, Pendimethalin @ 750g ha^{-1}at 3 DAT + one hand weeding at 30 DAT (T_2) followed by hand weeding twice at 15 and 30 DAT (T_9) (Table 4). Which was in line with the findings of Kumar *et al.* (2015) [6] and Prithvi *et al.* (2015) [17].

However, the variation in plant height and LAI showed non-significant result due to weed management practices at 30 DAT but at 60 DAT and at harvest Pendimethalin @ 750g ha^{-1}at 3 DAT + one hand weeding at 30 DAT (T_2) and hand weeding twice at 15 and 30 DAT (T_9) showed higher plant height and LAI, which might be due to less competition by weeds. Similar findings were recorded by Pradhan *et al.* (2010) [14] and Patil *et al.* (2014) [13]. The lowest plant height was recorded by Pendimethalin @ 750g ha^{-1}at 3 DAT + Bispyribac sodium @ 25g ha^{-1} at 25 DAT (T_4) at all the developmental stages (Table 4). This was mainly due to herbicide toxicity by both the herbicides as evidenced by Prithvi *et al.* (2015) [17] and Rao *et al.* (2015) [20].

The LAI was lowest in (T_{10}) unweeded control. This was mainly due to the suppression of crop growth due to weed species during the growth phases. Such suppression of crop growth due to weeds was reported by Ramamoorthy *et al.* (2002) [18].

Number of tillers and crop DMP were higher in Pendimethalin @ 750g ha^{-1}at 3 DAT + one hand weeding at 30 DAT (T_2) and hand weeding twice at 15 and 30 DAT (T_9) at all the growth stages (Table 4), (Table 5), (Fig. 1). This increase in crop growth parameters in these treatments was due to better control of weeds resulting in minimum competition of weeds with finger millet during crop growth period. Also this helped in better utilization of nutrients, moisture, space and light by the crop. Unweeded check recorded significantly lower number of tillers and crop DMP. This might be due to severe crop weed competition for the same growth resources. These results are in line with the findings of Patil *et al.* (2014) [13] and Kumar *et al.* (2015) [6].

The study indicated that keeping the plots weed free up to 40 DAT resulted in production of significantly higher values of growth components over the other weed management practices which was also visualised by Naik *et al.* (2001) [10] in transplanted finger millet.

Yield components

The yield components of finger millet *viz.*, productive tillers, number of ear heads m^{-2}, number of fingers ear $^{-1}$, number of grains ear $^{-1}$ and test weight were studied in the present investigation in relation to the weed management practices which revealed that number of ear heads m^{-2} played a dominant role in deciding the yield of the crop (Table 6). Similar results were also reported by Kumara *et al.* (2007) [7] in finger millet. The values of yield components were found to be superior in Pendimethalin @ 750g ha^{-1}at 3 DAT + one hand weeding at 30 DAT (T_2) followed by hand weeding twice at 15 and 30 DAT (T_9). It was due to reduced crop weed competition for nutrients, light, moisture and space and provided better environment for crop growth and development. Unweeded check treatment recorded poor yield components due to poor control of weeds which resulted in severe crop weed competition. This is in confirmation with the results of Kumara *et al.* (2007) [7], Patil *et al.* (2014) [13] and Kumar *et al.* (2015) [6]. The variation in number of grains ear $^{-1}$, test weight and harvest index was not much among the treatments in present in investigation due to the reason that these characters were genetic makeup of the plant which could not be influenced much by the weed management practices. Such results were also supported by Ganapathy *et al.* (2011) [4].

Yield

The grain yield of finger millet was significantly higher in Pendimethalin @ 750 g ha^{-1} at 3 DAT + one hand weeding at 30 DAT (T_2) followed by hand weeding twice at 15 and 30 DAT (T_9) (Table 6, Figure 4). The higher grain yield may be owing to significantly lower weed dry weight, higher weed control efficiency which reflected in higher values of plant height, number of effective tillers plant^{-1}, ear head m^{-2} and 1,000 grain weight. This was in line with the findings of Pradhan *et al.* (2010) [14], Patil *et al.* (2014) [13] and Kumar *et al.* (2015) [6]. Similar to that of grain yield, straw yield was also influenced by different weed management practices. The higher straw yield was recorded in hand weeding twice at 15 and 30 DAT (T_9) followed by Pendimethalin @ 750g ha^{-1}at 3 DAT + one hand weeding at 30 DAT (T_2). This higher yield might be due to better control of weeds at tillering stage of the crop which was also visualised by Pandey *et al.* (2014) [12] and Dhanapal *et al.* (2015) [3]. The study also reveals that early competition of the weeds must be avoided to make the crop in utilizing the inputs such as water, nutrients and light to produce superior yield. Similar reports on the importance of early weed control option was made by Naik *et al.* (2001) [10].

Nutrient uptake by plant and grain

The variation in nutrient uptake (N, P and K) by plant showed non-significant result due to weed management practices but the grain nutrient uptake (N, P and K) was higher in Pendimethalin @ 750g ha^{-1}at 3 DAT + one hand weeding at 30 DAT (T_2) followed by hand weeding twice at 15 and 30 DAT (T_9). Higher nutrient uptake was due to lower weed density and weed dry weight in these treatments which helped the crop to grow well, absorb more nutrient from the soil and efficiently supply the absorbed nutrients to economic part grain. These results were in line with Kumar *et al.* (2015) [6].

Table 1: Weed floristic composition in experimental field (Unweeded control).

Botanical name	Common name	Life span	Family	AD (Number m^{-2})		RD (%)	
				30DAT	60DAT	30DAT	60DAT
Grasses							
Echinochloa colonum Link.	Jungle grass	Annual	Poaceae	99.75	66.25	61.71	53.43
Cyanodon dactylon (L.) Pers	Bermuda grass	Perennial	Poaceae	5.25	-	3.25	-
Chloris barbata Sw.	Purple chloris	Annual	Poaceae	10	-	6.24	
Eleusine indica (L.) *Gaertn.*	Indian goose grass	Annual	Poaceae	18.6-	4.31	11.51	3.48
Dactiloctinium aegiptium L.	Crow foot grass	Annual	Poaceae	-	23.1	-	18.63
Total grasses				133.66	93.66	82.71	75.54
Sedges							
Cyperus rotundus Linn.	Purple nut sedge	Perennial	Cyperaceae	14.33	14	8.87	11.30
Total sedges				14.33	14	8.87	11.30

Broad leaved weeds							
Eclipta alba L.	False daisy	Annual	Asteraceae	9.5	10	5.88	8.06
Aeschynomene indica L.	Indian joint watch	Perennial	Fabaceae	0.5	3.1	0.31	2.5
Cleome viscose L.	Wild mustard	Annual	Capparidaceae	0.5	0.5	0.31	0.4
Corchorus trilocularis (Auct.)	Jute mallow	Annual	Malvaceae	3.10	2.23	1.92	1.8
Alysicarpus rugosus (Willd.) DC.	Red moneywort	Annual	Fabaceae	.-	0.5	-	0.4
Total broad leaved weeds				13.66	16.33	8.42	13.16
			Total	161.65	124.0	100	100

AD: Absolute density RD: Relative density

Table 2: Total dry weight of weeds (g m^{-2}) at different growth stages as influenced by weed control treatments in Finger millet.

Treatments	30 DAT	60 DAT	Harvest
T_1: Application of Pendimethalin @750g ha^{-1} at 3 DAT.	5.5 (30.08)	4.8 (22.36)	4.0 (15.96)
T_2: T_1 + one hand weeding at 30 DAT.	5.7 (32.04)	2.5 (5.35)	2.5 (6.1)
T_3: T_1 + one weeding by peg type weeder at 30 DAT.	4.7 (22.12)	3.6 (13.21)	3.1 (9.07)
T_4: T_1 + Bispyribac sodium @ 25g ha^{-1} at 25 DAT.	5.7 (32.15)	3.9 (14.83)	3.9 (16.14)
T_5: Application of Bispyribac sodium @ 25g ha^{-1} at 15 DAT.	6.6 (43.91)	5.4 (29.27)	5.4 (29.35)
T_6: T_5 + one hand weeding at 30 DAT.	6.7 (45.64)	3.2 (10.12)	2.7 (7.13)
T_7: T_5 + one weeding by peg type weeder at 30 DAT.	7.1 (50.26)	4.7 (21.5)	4.9 (24.65)
T_8: Weeding twice by peg type weeder at 15 & 30 DAT	5.2 (30.17)	3.9 (15.22)	4.8(25.61)
T_9: Hand weeding twice at 15 & 30 DAT.	4.7 (21.61)	2.4 (5.5)	2.4 (5.55)
T_{10}: Unweeded control.	8.6 (74.12)	7.7 (59.45)	9.1 (83.3)
S.Ed	0.87	0.64	0.90
CD (p=0.05)	1.83	1.35	1.9

Figures in parenthesis indicate original values

*Observation were recorded prior to imposing of HW for all treatments.

Table 3: Total nutrient uptake by weeds (kg ha^{-1}) as influenced by weed control treatments in finger millet.in Finger millet.

Treatments	N	P	K
T_1: Application of Pendimethalin @750g ha^{-1} at 3 DAT.	0.2	0.2	0.9
T_2: T_1 + one hand weeding at 30 DAT.	0.2	0.1	0.7
T_3: T_1 + one weeding by peg type weeder at 30 DAT.	0.2	0.1	0.9
T_4: T_1 + Bispyribac sodium @ 25g ha^{-1} at 25 DAT.	0.2	0.2	1.1
T_5: Application of Bispyribac sodium @ 25g ha^{-1} at 15 DAT.	0.4	0.3	1.4
T_6: T_5 + one hand weeding at 30 DAT.	0.2	0.2	0.6
T_7: T_5 + one weeding by peg type weeder at 30 DAT.	0.3	0.2	1.3
T_8: Weeding twice by peg type weeder at 15 & 30 DAT	0.3	0.3	1.2
T_9: Hand weeding twice at 15 & 30 DAT.	0.2	0.1	0.7
T_{10}: Unweeded control.	0.5	0.5	2.5
S.Ed	0.09	0.05	0.28
CD (p=0.05)	0.19	0.11	0.6

Table 4: Growth components at different growth stages as influenced by weed control treatments in Finger millet Plant height (cm), Leaf area index No. of tillers (hill^{-1})

Treatments	30 DAT	60 DAT	Harvest	30 DAT	60 DAT	Harvest	30 DAT	60 DAT	Harvest
T_1: Application of Pendimethalin @750g ha^{-1} at 3 DAT.	53.5	72.4	71.7	1.4	1.7	1.2	4	4	4
T_2: T_1 + one hand weeding at 30 DAT.	50.2	74.1	74.7	1.6	2.2	2.1	5	5	5
T_3: T_1 + one weeding by peg type weeder at 30 DAT.	54.7	72.7	73.8	1.5	1.8	1.7	4	4	4
T_4: T_1 + Bispyribac sodium @ 25g ha^{-1} at 25 DAT.	48.1	59.6	62.0	1.6	1.7	1.5	4	4	4
T_5: Application of Bispyribac sodium @ 25g ha^{-1} at 15 DAT.	49.3	69.8	70.2	1.2	1.6	0.7	4	4	4
T_6: T_5 + one hand weeding at 30 DAT.	50.6	69.9	69.8	1.5	1.9	1.3	5	4	4
T_7: T_5 + one weeding by peg type weeder at 30 DAT.	50.6	68.1	68.3	1.3	1.4	1.0	4	4	3
T_8: Weeding twice by peg type weeder at 15 & 30 DAT	54.7	72.3	72.7	1.5	1.7	0.7	4	4	4
T_9: Hand weeding twice at 15 & 30 DAT.	54.1	74.2	74.4	1.6	2.4	1.7	5	5	5
T_{10}: Unweeded control.	51.7	68.5	70.8	1.2	0.7	0.6	3	3	3
S.Ed	3.62	2.85	3.33	0.19	0.41	0.35	0.68	0.28	0.27
CD (p=0.05)	NS	5.98	7.01	NS	0.86	0.73	1.44	0.6	0.57

Table 5: Crop dry matter production (kg ha^{-1}) at different growth stages as influenced by weed control treatments in Finger millet.

Treatments	30 DAT	60 DAT	Harvest
T_1: Application of Pendimethalin @750g ha^{-1} at 3 DAT.	2254.3	7217.3	9753.1
T_2: T_1 + one hand weeding at 30 DAT.	3049.4	9665.2	13261.7
T_3: T_1 + one weeding by peg type weeder at 30 DAT.	2396.5	9590.6	12061.2
T_4: T_1 + Bispyribac sodium @ 25g ha^{-1} at 25 DAT.	2142.7	7548.1	11674.1
T_5: Application of Bispyribac sodium @ 25g ha^{-1} at 15 DAT.	1892.8	6372.8	9862.2
T_6: T_5 + one hand weeding at 30 DAT.	2072.6	7577.3	11355.6
T_7: T_5 + one weeding by peg type weeder at 30 DAT.	1990.6	7042.0	10380.2
T_8: Weeding twice by peg type weeder at 15 & 30 DAT	2193.1	7296.3	9975.3
T_9: Hand weeding twice at 15 & 30 DAT.	2908.6	9593.8	12330.9
T_{10}: Unweeded control.	1438.5	4958.0	6385.2
S.Ed	334.1	823.2	1112.9
CD (p=0.05)	702.1	1729.7	2338.2

Table 6: Yield contributing characters and yield as influenced by weed control treatments in Finger millet.

Treatments	Productive tillers per hill (No. $hill^{-1}$)	No. of ear heads m^{-2}	No. of fingers ear^{-1}	No. of grains ear^{-1}	Test weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
T_1: Application of Pendimethalin @750g ha^{-1} at 3 DAT.	4	103.0	6	1284.8	2.77	1791.4	5244.4
T_2: T_1 + one hand weeding at 30 DAT.	5	127.0	7	1462.7	3.31	2416.5	6176.2
T_3: T_1 + one weeding by peg type weeder at 30 DAT.	4	112.0	6	1364.7	2.77	1847.3	5563.5
T_4: T_1 + Bispyribac sodium @ 25g ha^{-1} at 25 DAT.	4	114.0	6	1307.1	2.87	2010.8	5612.7
T_5: Application of Bispyribac sodium @ 25g ha^{-1} at 15 DAT.	4	102.0	6	1215.5	2.62	1567.0	4355.6
T_6: T_5 + one hand weeding at 30 DAT.	4	116.0	6	1290.7	2.94	1880.0	5507.9
T_7: T_5 + one weeding by peg type weeder at 30 DAT.	4	112.7	6	1284.6	2.69	1736.5	5131.7
T_8: Weeding twice by peg type weeder at 15 & 30 DAT	4	110.7	6	1275.9	2.79	1782.2	5452.4
T_9: Hand weeding twice at 15 & 30 DAT.	4	123.3	6	1415.9	2.86	2023.2	6293.7
T_{10}: Unweeded control.	2	88.0	5	987.0	2.44	1061.0	4181.6
S.Ed.	0.38	7.81	0.23	110.42	0.18	211.09	496.5
CD (p=0.05)	0.81	16.4	0.49	232.0	0.39	443.5	1043.3

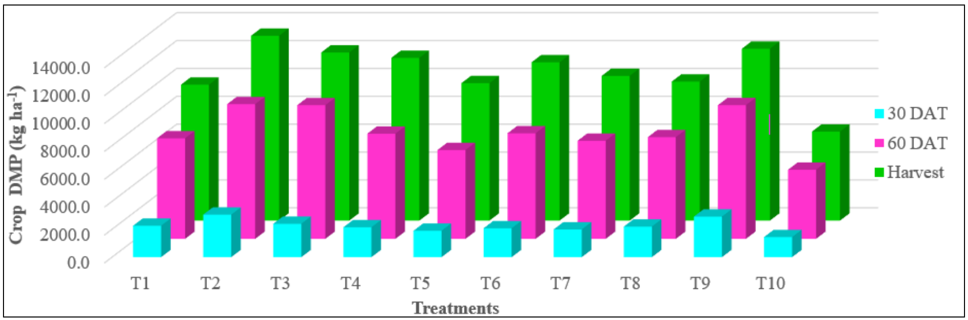

Fig 1: Crop dry matter production (kg ha^{-1}) at different growth stages as influenced by weed control treatments in Finger millet

T1- Pendimethalin @ 750g ha-1 ¬at 3 DAT; T2- T1 + one HW at 30 DAT; T3- T1 + one weeding by peg type weeder at 30 DAT; T4- T1 + Bispyribac sodium @ 25g ha-1 at 25 DAT; T5- Bispyribac sodium @ 25g ha-1 at 15 DAT; T6- T5 + one HW at 30 DAT; T7- T5 + one weeding by peg type weeder at 30 DAT; T8- Peg weeding; twice at 15 and 30 DAT; T9- HW twice at 15 and 30 DAT; T10- Unweeded control

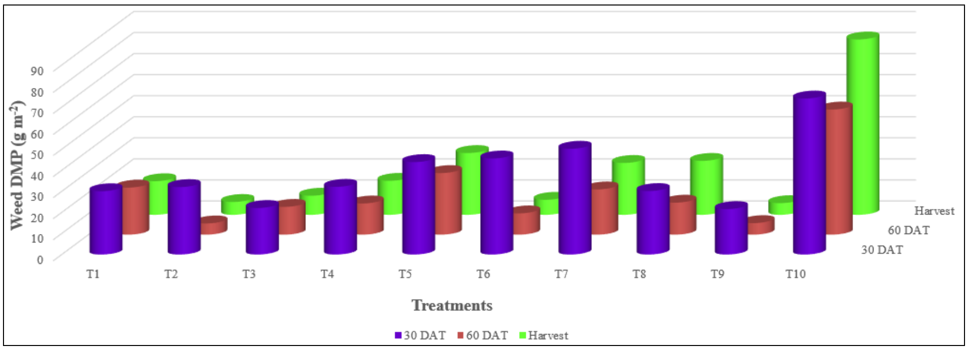

Fig 2: Total dry weight of weeds (g m^{-2}) at different growth stages as influenced by weed control treatments in Finger millet

T_1- Pendimethalin @ 750g ha^{-1} at 3 DAT; T_2- T_1 + one HW at 30 DAT; T_3- T_1 + one weeding by peg type weeder at 30 DAT; T_4- T_1 + Bispyribac sodium @ 25g ha^{-1} at 25 DAT; T_5- Bispyribac sodium @ 25g ha^{-1} at 15 DAT; T_6- T_5 + one HW at 30 DAT; T_7- T_5 + one weeding by peg type weeder at 30 DAT; T_8- Peg weeding; twice at 15 and 30 DAT; T_9- HW twice at 15 and 30 DAT; T_{10}- Unweeded control

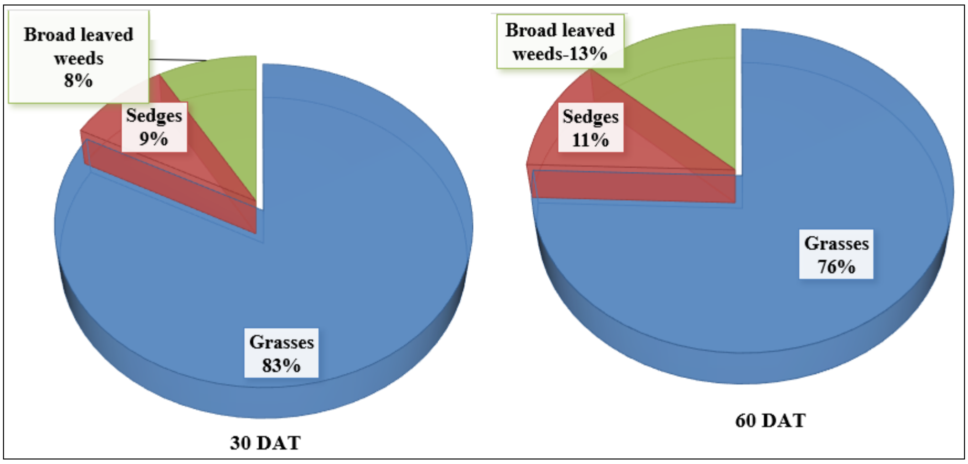

Fig 3: Weed floristic composition in the experimental field at 30 and 60 DAT

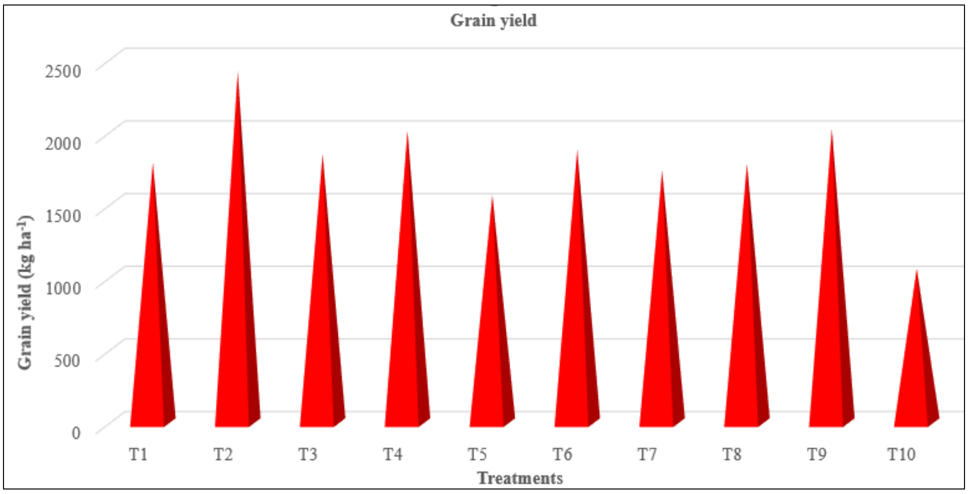

Fig 4: Grain yield (kg ha-1) as influenced by weed control treatments in Finger millet.

T_1- Pendimethalin @ 750g ha^{-1} at 3 DAT; T_2- T_1 + one HW at 30 DAT; T_3- T_1 + one weeding by peg type weeder at 30 DAT; T_4- T_1 + Bispyribac sodium @ 25g ha^{-1} at 25 DAT; T_5- Bispyribac sodium @ 25g ha^{-1} at 15 DAT; T_6- T_5 + one HW at 30 DAT; T_7- T_5 + one weeding by peg type weeder at 30 DAT; T_8- Peg weeding twice at 15 and 30 DAT; T_9- HW twice at 15 and 30 DAT; T_{10}- Unweeded control

Conclusion

The results of this investigation indicate that, when compared to other weed management techniques in transplanted finger millet, the application of Pendimethalin @ 750g ha^{-1} at 3 DAT + one hand weeding at 30 DAT had lower weed dry weight, less nutrient uptake by weeds, high uptake of nutrients by crop during the critical period of crop weed competition and increased performance of growth and yield attributes during the crop growth period.

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