The Pharma Innovation Journal 2022; 11(6): 1905-1909

www.ThePharmaJournal.com

The Pharma Innovation

**ISSN (E): 2277-7695**
**ISSN (P): 2349-8242**
**NAAS Rating: 5.23**
TPI 2022; 11(6): 1905-1909

www.thepharmajournal.com
Received: 02-04-2022
Accepted: 09-05-2022

**Saloni Patil**
Department of Agronomy, School of Agriculture, Lovely Professional University, Punjab, India

**Corresponding Author:**
**Saloni Patil**
Department of Agronomy, School of Agriculture, Lovely Professional University, Punjab, India

# Integrated weed management studies in *kharif* maize (*Zea mays* L.)

## Saloni Patil

**Abstract**
A field experiment was carried out during *kharif* 2021 at Agronomy Research Farm, Lovely Professional University, Phagwara, Punjab. The experiment was conducted in Randomized Block Design with fifteen treatments and four replications. PMH- 13 variety was used during the research trial and was sown on 3rd June, 2021. Recommended fertilizer dose of 125:62.5:30 kg NPK/ha$^{-1}$ was applied to the maize crop.
Weed count was significantly less in intercropping of cowpea (pendimethalin 0.75 kg/ha, pre-em) f.b. earthing up treatment, which was at par with two hand weeding, atrazine 1kg per ha$^{-1}$,pre-em f.b straw mulching, intercropping of cowpea f.b earthing up, atrazine band plus one interculture and plastic mulch treatments. Periodic weed dry matter accumulation was significantly less in intercropping of cowpea (pendimethalin 0.75 kg/ha$^{-1}$, pre-em) f.b. earthing up, and two hand weedings (3 and 5 WAS), atrazine 1kg per ha$^{-1}$, pre-em f.b. straw mulching and intercropping of cowpea (pendimethalin 0.75 kg/ha$^{-1}$, pre-em) f.b. earthing up as compared to atrazine + pendimethalin (1.0 + 0.75 kg/ha$^{-1}$), atrazine 1.0 kg/ha$^{-1}$ f.b earthing up, atrazine 1.0 kg f.b 2,4-D and ridge planting treatments. However significantly high weed count and weed dry matter accumulation was recorded in unweeded (control) plot as compared to other treatments.
All growth attributes along with yield parameters were significantly better in intercropping of cowpea (Pendimethalin 0.75 kg/ha$^{-1}$, pre-em) f.b. earthing up which were at par with two hand weedings (3 and 5 WAS) and atrazine 1kg per ha$^{-1}$, pre-em f.b. straw mulching. Highest seed yield was obtained in in intercropping of cowpea (pendimethalin 0.75 kg/ha$^{-1}$, pre-em) f.b. earthing up (58.33 q/ha$^{-1}$) which were at par with with two hand weedings (58.10 q/ha$^{-1}$) and atrazine 1kg per ha$^{-1}$, pre-em f.b. straw mulching (57.63 q/ha$^{-1}$) which was 46.19%, 45.61% and 44.43%. However significantly less yield was recorded in weedy check (39.90 q/ha$^{-1}$) as compared to all other treatments.

**Keywords:** Management, Agronomy, *Zea mays* L. *kharif*

## Introduction
Maize (*Zea mays* L.) is one of the most versatile cereal crops, able to thrive in a wide range of soil and climatic conditions. After wheat and rice, maize is considered as the third most important crop. The United States of America (USA) is the largest producer of maize contributing nearly 35 percent of total production in the world. The USA alone has the highest productivity (>9.6 t ha$^{-1}$) which is double the global average (4.92 t ha$^{-1}$). Whereas the average productivity of India is 2.43 t ha$^{-1}$ (Nand *et al*., 2018) [7]. In India, cereals occupy about 54 percent of the total cropped area of which maize occupies 3.61 percent of the total cropped area. In India, it is cultivated on an area of 8.69 million ha with a production of 21.81 million tonnes and productivity of 2509 kg/ha contributing nearly 9.0 percent of total food grain production in the country (Kumavat *et al*., 2019) [6]. The major maize-producing states are Andhra Pradesh, Karnataka, Rajasthan, Bihar, Maharashtra, and Uttar Pradesh which share 60 percent of the area and 70 percent of production in the country.
Low maize productivity in India relative to the rest of the world can be attributed to a number of causes, the most notable of which is poor weed management, which causes a severe danger to crop yield. Weeds primarily interfere with field crops by creating severe competition for soil water, light, space and nutrients. Depending on the weed type and density, weeds reduce maize yield by 33-50% and it is well understood that if weeds are not controlled during critical crop-weed competition period, grain losses can range from 28 to 100% (Kumawat *et al*., 2019) [6]. Due to wider row spacing, weed management in corn can be highly sophisticated and also labor-intensive. Weed management is considered an important factor in achieving higher productivity as weed problems are more extreme in the early stages of maize growth especially during persistent rainy spells, which cannot be managed by traditional and cultural practices alone because of too much wetness. The critical period can be used to identify the periods of

crop growth that are most susceptible to weed competition. In maize, the important period for weed control is 3 to 6 weeks after crop emergence. Herbicides have long been the favoured method of weed control in maize; but, in addition to their benefits, they have also been linked to negative consequences, such as soil and ground water contamination, altered floristic composition of plant communities, and the emergence of weed resistance.

The Integrated Weed Management (IWM) approach is use of more than one method of weed control which advocates the use of all available weed control options. IWM components such as use of cover crops, high crop density, placement of fertilizer, drip irrigation etc. could be used to effectively manage weeds on with small farm holdings. In maize and maize-based intercropping systems, a weed management strategy including intercropping and use of non-chemical methods is critical for achieving high yields. Also weed seed bank status of the field can be reduced significantly with the adoption of IWM as compared to other methods of weed control.

## Material and Methods

A study was carried out at the research farm of the Department of Agronomy, Lovely Professional University, Phagwara (Punjab) during the *kharif* session of 2021 to determine, integrated weed management studies in *kharif* maize (*Zea mays*. L). fifteen treatments were laid out in randomized block design and were replicated four times. T1-Laudis 42 SC (Tembotrione) 110 gm a.i/ha$^{-1}$, post em,T2-Atrazine+ pendimethalin (1+0.75 kg/ha$^{-1}$) pre em, T3-Atrazine 1kg per ha$^{-1}$, pre-em f.b. 1 HW (30 DAS),T4-Atrazine 1kg per ha$^{-1}$, pre-em f.b. earthing up (45 DAS), T5-Pendimethalin 0.75kg/ha$^{-1}$, pre-em f.b. 1 HW (30 DAS), T6-Pendimethalin 0.75kg/ha$^{-1}$, pre-em f.b. earthing up (45 DAS), T7-Atrazine 1kg per ha$^{-1}$, pre-em + straw mulching, T8-Atrazine 1kg per ha$^{-1}$, pre-em f.b. 2,4-D amine 58 EC 0.58 kg a.i/ha$^{-1}$ post em, T9- Intercropping of cowpea f.b. earthing up (45 DAS), T10-Intercropping of cowpea (pendimethalin 0.75 kg/ha$^{-1}$, pre-em) f.b. earthing up (45 DAS), T11-Atrazine 0.33 kg/ha$^{-1}$ band application f.b. interculture, T12- Black plastic mulch, T13-Ridge planting, T14- Two hand weedings (3 and 5 WAS) and T15- Unweeded (control). The size of individual plot was 5m x 2.75m. Variety used in this experiment was PMH-13, sown on 3$^{rd}$ June 2021 with spacing of 60 cm (row to row) and 30 cm (plant to plant), sown at the seed rate of 20 kg/ha$^{-1}$. Three to four irrigations were given throughout the life cycle of maize crop. Emamectin benzoate 5% SG was sprayed at 0.4g/l for the control of fall armyworm.

## Results and Discussion

### 1. Effect on weeds

The data on weed count per square meter, dry matter accumulation by weeds (q/ha) and WCE are presented in Table 1. At the time of harvest the minimum weed count was exhibited by intercropping of cowpea (pendimethalin 0.75 kg/ha$^{-1}$, pre-em) f.b. earthing up (8.33 m$^{-2}$) and this treatment was found to be at par with two hand weeding (10.82 m$^{-2}$), atrazine 1kg per ha$^{-1,}$ pre-em f.b straw mulching (14.56 m$^{-2}$), intercropping of cowpea f.b earthing up, atrazine band(0.33 kg/ha$^{-1}$) plus one interculture and plastic mulch treatments. A significantly higher total weed count of 77.70 m$^{-2}$ was recorded in unweeded (control) than all other weed control treatments. Similar findings were reported by Sraw *et al*., 2016 and Dubey *et al*., 2008 [11, 3].

The maximum weed dry matter of 64.75 q/ha$^{-1}$ was recorded in control (unweeded) plot which was significantly higher than all integrated weed control treatments (Table 1). The minimum weed dry matter accumulation of 1.01 q/ha$^{-1}$ was observed in intercropping of cowpea (pendimethalin 0.75 kg/ha$^{-1}$, pre-em) f.b. earthing up which was at par with two hand weedings (3 and 5 WAS) and atrazine 1kg per ha$^{-1}$, pre-em f.b. straw mulching as shown in Table 1. Jamshidi *et al*., 2013 [4] reported that cowpea as a living mulch, reduced the weed biomass upto 45.5% and 39.6% when intercropped with maize at a density of 7.5 and 9 plants m-2, respectively.

Weed control efficiency (WCE) which was calculated at time of harvest, indicated that the maximum weed control efficiency of 98.44% was observed in treatment with intercropping of cowpea (pendimethalin 0.75 kg/ha$^{-1}$, pre-em) f.b. earthing and this was followed by two hand weeding (98.22%). Minimum weed control efficiency was recorded in pre-em application of atrazine + pendimethalin (1.0 kg + 0.75 kg/ha$^{-1}$) and atrazine 1.0 kg/ha$^{-1}$ (pre-em) f.b 2, 4-D post-em. According to Sraw *et al*., 2016 [11], cowpea (mulch 30 DAS) in maize had the highest weed control efficiency (91.6%), followed by fodder cowpea (30 DAS).

### 2. Effect on crop growth and yield

### a. Crop parameters

Plant height was significantly more in intercropping of cowpea (pendimethalin 0.75 kg/ha$^{-1}$, pre-em) f.b. earthing up (228.52 cm) which was statistically at par with two hand weeding (223.42 cm) and atrazine 1kg per ha$^{-1}$, pre-em f.b. straw mulching (222.62 cm). Intercropping of cowpea (pendi. 0.75 kg/ha$^{-1}$, pre-em) f.b earthing up provided weed free environment for growth of crop. Minimum plant height of 180.92 cm was recorded in weedy check (control) and it being significantly low than all other weed control treatments (Table 2). Similar findings were reported by Barla *et al*., 2016 [1].

The highest dry matter (Table 2) was recorded in treatment with intercropping of cowpea (pendi. 0.75 kg/ha$^{-1}$, pre-em) f.b. earthing up which was 646.17 gms per plant and this treatment was at par with two hand weeding (628.42 gms per plant) and atrazine 1kg per ha$^{-1}$, pre-em f.b. straw mulching (627.21 gms per plant). The lowest dry matter accumulation was seen in weedy check i.e 375.21 gms per plant which was significantly low than all weed control treatments except plastic mulch treatment. Similar findings were recorded by Singh *et al*., 2015 [9].

The number of leaves were significantly influenced by various weed management practices (Table 2). The minimum number of leaves (9.25) were observed in weedy check (control) which were significantly less than all weed control treatments. Maximum number of leaves were observed in intercropping of cowpea (pendimethalin 0.75 kg/ha$^{-1}$, pre-em) f.b. earthing up (13.62) which was at par with two hand weeding (13.0). Intercropping of cowpea (pendimethalin 0.75 kg/ha$^{-1}$, pre-em) f.b. earthing up recorded more number of leaves / plant due to better crop growth. Similar findings were reported by Rajeshkumar *et al*., 2018 [8].

**Table 1:** Influence of different weed control treatments on weed count, weed dry matter and weed control efficiency

| Treatment | Weed count ($m^{-2}$) | Weed dry matter (q/$ha^{-1}$) | Weed control efficiency (%) |
|---|---|---|---|
| T1- Tembotrione at 110g a.i/$ha^{-1}$, post-em (30 DAS) | 29.13 | 7.16 | 88.94 |
| T2- Atrazine+ pendimethalin (1+0.75 kg/$ha^{-1}$) pre em. | 55.50 | 14.19 | 78.08 |
| T3- Atrazine 1kg/$ha^{-1}$, pre em f.b 1 HW (30DAS) | 34.68 | 3.34 | 94.84 |
| T4- Atrazine 1kg/$ha^{-1}$, pre-em f.b earthing up (45DAS) | 41.62 | 6.54 | 89.89 |
| T5- Pendimethalin 0.75 kg/$ha^{-1}$, pre-em f.b 1HW (30 DAS) | 38.85 | 3.57 | 94.48 |
| T6- Pendimethalin at 0.75 kg/$ha^{-1}$, pre-em f.b earthing up(45DAS) | 27.75 | 2.28 | 96.47 |
| T7- Atrazine 1kg/$ha^{-1}$, f.b + straw mulching | 14.56 | 1.99 | 96.92 |
| T8- Atrazine 1kg/$ha^{-1}$, pre-em f.b 2,4-D amine 0.58kg a.i/$ha^{-1}$, post-em.(30 DAS) | 33.30 | 13.86 | 78.59 |
| T9- Intercropping cowpea f.b earthing up (45 DAS) | 15.95 | 2.11 | 96.74 |
| T10- Intercropping cowpea (pendimethalin 0.75 kg/$ha^{-1}$), pre-em f.b earthing up (45 DAS) | 8.33 | 1.01 | 98.44 |
| T11- atrazine 0.33 kg/$ha^{-1}$, pre-em band application+ interculture | 15.95 | 2.32 | 96.41 |
| T12- Black plastic mulch | 18.03 | 3.81 | 94.11 |
| T13- Ridge planting | 22.89 | 10.43 | 83.89 |
| T14- Two hand weeding (3 and 5 WAS) | 10.82 | 1.15 | 98.22 |
| T15- Unweeded (control) | 77.70 | 64.75 | - |
| C.D at 5% | 10.98 | 1.91 | N.A |

**b. Yield attributes**

The data pertaining to number of cobs per plant has been shown in the Table 3. The data reveals that the higher number of cobs per plant has been recorded in treatment with intercropping of cowpea (pendimethalin 0.75 kg/$ha^{-1}$, pre-em) f.b. earthing up (2.0) which was followed by two hand weeding (1.62) and atrazine 1kg per $ha^{-1}$, pre-em f.b. straw mulching (1.50). the lowest number of 1.12 cobs per plant were recorded in control plot which were significantly less than two hand weeding and intercropping of cowpea (pendimethalin 0.75 kg/$ha^{-1}$, pre-em) f.b earthing up treatments. Similar results were found by Talebbeigi *et al*., 2012 [13].

The data revealed that the highest cob girth of 4.68 cm has been recorded in treatment with intercropping of cowpea (pendimethalin 0.75 kg/$ha^{-1}$, pre-em) f.b. earthing up (Table 3). This treatment was found to be at par with two hand weeding (4.65cm) and atrazine 1.0 kg per $ha^{-1}$, pre-em f.b. straw mulching (4.63cm). Treatment intercropping of cowpea (pendimethalin 0.75 kg/$ha^{-1}$, pre-em) f.b. earthing up, two hand weeding and atrazine 1kg per $ha^{-1}$, pre-em f.b. straw mulching were found to be significantly superior in comparison to other weed control treatments except atrazine + pendimethalin (1.0 kg + 0.75 kg pre-em.), atrazine 1.0 kg pre-em. f.b hand weeding, pendimethalin 0.75 + hand weeding and plastic mulch treatments. However, the lowest cob girth of 3.86 cm was recorded in control plot. Similar findings were recorded by Das *et al*., 2016 [2].

The data presented in Table 3, shows that treatment with intercropping of cowpea (pendimethalin 0.75 kg/ha, pre-em) f.b. earthing up recorded the highest cob length of 18.12 cm whereas the lowest cob length of 13.58 cm was recorded by the unweeded plot. Two hand weeding (17.66 cm) and atrazine 1kg per $ha^{-1}$, pre-em f.b. straw mulching (17.50 cm) were at par with best treatment which was intercropping of cowpea (pendimethalin 0.75 kg/$ha^{-1}$, pre-em) f.b. earthing up (18.12 cm). Similar results were found by Talebbeigi *et al*., 2012 [13].

The highest test weight was recorded in the treatment with intercropping of cowpea (pendimethalin 0.75 kg/$ha^{-1}$, pre-em) f.b. earthing up (266.75 gms) which was found at par with two hand weeding (257.25 gms) and atrazine 1.0 kg per $ha^{-1}$, pre-em f.b. straw mulching (262.25 gms).(Table 3) Significantly the lowest test weight was recorded in weedy check i.e 219.75 gms as compared to all other weed control treatments. Similar results were reported by Singh *et al*., 2018 [10].

**c. Grain and stover yield**

The data pertaining to the effect of different treatments on yield of *kharif* maize is given in the Table 5. Among the different treatments significantly higher yield of 58.33 q/ha was exhibited by intercropping of cowpea (pendimethalin 0.75 kh/$ha^{-1}$ pre-em) f.b earthing up 45 DAS which was statistically at par with two hand weeding (58.10q/$ha^{-1}$) and atrazine 1kg per ha, pre-em f.b. straw mulching (57.63 q/$ha^{-1}$) and all these treatments were found to be significantly superior to all other weed control treatments and grain yield was increased by 46.19%, 45.61% and 44.43% over unweeded control respectively (Table 4). Significantly lowest yield (39.90 q/$ha^{-1}$) was recorded with control treatment as compared to all other treatments. According to Singh *et al*., 2015 [9] due to the smothering impact of cowpea on weed development, the maize + cowpea treatment resulted in a reduced weed index. Over weedy control, using cowpea as a live mulch enhanced maize production by 23.7 and 44.5%, respectively. The maize + cowpea treatment produced the maximum pooled system productivity as maize equivalent yield (14 136 kg/$ha^{-1}$), which was comparable to atrazine or metribuzin as PE + one HW.

The lowest stover yield of 74.17 q/$ha^{-1}$ has been recorded in unweeded plot which was significantly less than all weed control treatments (Table 4). Contrary, the highest stover yield of 119.84 q/$ha^{-1}$ has been recorded in treatment with intercropping of cowpea (pendimethalin 0.75 kg/$ha^{-1}$ pre-em) f.b earthing up 45 DAS which was at par with two hand weeding (118.09q/$ha^{-1}$) and atrazine 1kg per $ha^{-1}$, pre-em f.b. straw mulching (116.93q/$ha^{-1}$). Similar results were given by Malviya *et al*., 2012.

Biological yield of 178.01 q/$ha^{-1}$ has been recorded in treatment with intercropping of cowpea (pendimethalin 0.75 kg/$ha^{-1}$ pre-em) f.b earthing up 45 DAS (Table 4). This treatment was at par with two hand weeding and atrazine 1kg per $ha^{-1}$, pre-em f.b. straw mulching with 176.15 q/$ha^{-1}$ and 174.40 q/ha respectively. However the lowest biological yield of 114.02 q/$ha^{-1}$ was recorded in weedy plot which was significantly less than all weed control treatments. Similar results were found by Suroshe *et al*., 2005 [12].

**Table 2:** Influence of different weed control treatments on plant height, plant dry matter, number of leaves per plant and number of nodes per plant

| Treatments | Plant height (cm) | Plant dry matter (gm) | No. of leaves/plant |
|---|---|---|---|
| T1- Tembotrione at 110g a.i/ha$^{-1}$, post-em (30 DAS) | 204.50 | 466.69 | 12.25 |
| T2- Atrazine+ pendimethalin (1+0.75 kg/ha$^{-1}$) pre em. | 198.12 | 411.21 | 11.62 |
| T3- Atrazine 1kg/ha$^{-1}$, pre em f.b 1 HW (30DAS) | 210.61 | 501.39 | 11.75 |
| T4- Atrazine 1kg/ha$^{-1}$, pre-em f.b earthing up (45DAS) | 203.60 | 423.49 | 12.00 |
| T5- Pendimethalin 0.75 kg/ha$^{-1}$, pre-em f.b 1HW (30 DAS) | 206.70 | 422.14 | 11.75 |
| T6- Pendimethalin at 0.75 kg/ha$^{-1}$, pre-em f.b earthing up(45DAS) | 210.17 | 461.29 | 11.75 |
| T7- Atrazine 1kg/ha$^{-1}$, f.b + straw mulching | 222.62 | 627.21 | 12.87 |
| T8- Atrazine 1kg/ha$^{-1}$, pre-em f.b 2,4-D amine 0.58kg a.i/ha$^{-1}$, post-em.(30 DAS) | 211.67 | 469.01 | 12.12 |
| T9- Intercropping cowpea f.b earthing up (45 DAS) | 214.43 | 553.36 | 11.87 |
| T10- Intercropping cowpea (pendimethalin 0.75 kg/ha$^{-1}$), pre-em f.b earthing up (45 DAS) | 228.52 | 646.17 | 13.62 |
| T11- atrazine 0.33 kg/ha$^{-1}$, pre-em band application+ interculture | 215.23 | 464.67 | 11.87 |
| T12- Black plastic mulch | 204.66 | 402.15 | 10.62 |
| T13- Ridge planting | 208.76 | 442.19 | 11.87 |
| T14- Two hand weeding (3 and 5 WAS) | 223.40 | 628.42 | 13.00 |
| T15- Unweeded (control) | 180.92 | 375.21 | 9.25 |
| C.D at 5% | 10.03 | 19.11 | 0.70 |

**Table 3:** Influence of different weed control treatments on number of cobs per plant, length of cob, girth of cob and test weight

| Treatment | No. of cobs/plant | Length of cob (cm) | Girth of cob (cm) | Test weight (%) |
|---|---|---|---|---|
| T1- Tembotrione at 110g a.i/ha$^{-1}$, post-em (30 DAS) | 1.18 | 16.50 | 4.42 | 257.75 |
| T2- Atrazine+ pendimethalin (1+0.75 kg/ha$^{-1}$) pre em. | 1.22 | 14.37 | 4.36 | 252.50 |
| T3- Atrazine 1kg/ha$^{-1}$, pre em f.b 1 HW (30DAS) | 1.20 | 15.20 | 4.44 | 249.25 |
| T4- Atrazine 1kg/ha$^{-1}$, pre-em f.b earthing up (45DAS) | 1.20 | 14.62 | 4.49 | 255.50 |
| T5- Pendimethalin 0.75 kg/ha$^{-1}$, pre-em f.b 1HW (30 DAS) | 1.17 | 14.45 | 4.40 | 244.75 |
| T6- Pendimethalin at 0.75 kg/ha$^{-1}$, pre-em f.b earthing up(45DAS) | 1.19 | 14.29 | 4.30 | 240.75 |
| T7- Atrazine 1kg/ha$^{-1}$, f.b + straw mulching | 1.50 | 17.50 | 4.63 | 262.25 |
| T8- Atrazine 1kg/ha$^{-1}$, pre-em f.b 2,4-D amine 0.58kg a.i/ha$^{-1}$, post-em.(30 DAS) | 1.18 | 16.33 | 4.44 | 257.00 |
| T9- Intercropping cowpea f.b earthing up (45 DAS) | 1.35 | 16.41 | 4.23 | 258.00 |
| T10- Intercropping cowpea (pendimethalin 0.75 kg/ha$^{-1}$), pre-em f.b earthing up (45 DAS) | 2.00 | 18.12 | 4.68 | 266.75 |
| T11- atrazine 0.33 kg/ha$^{-1}$, pre-em band application+ interculture | 1.25 | 16.75 | 4.49 | 253.00 |
| T12- Black plastic mulch | 1.21 | 15.41 | 4.47 | 248.50 |
| T13- Ridge planting | 1.23 | 14.50 | 4.28 | 257.25 |
| T14- Two hand weeding (3 and 5 WAS) | 1.62 | 17.66 | 4.65 | 265.25 |
| T15- Unweeded (control) | 1.12 | 13.58 | 3.86 | 219.75 |
| C.D at 5% | 0.26 | 1.20 | 0.16 | 6.46 |

**Table 4:** Influence of different weed control treatments on grain yield, stover yield and biological yield

| Treatment | Grain yield (q/ha) | Stover yield (q/ha) | Biological yield (q/ha) |
|---|---|---|---|
| T1- Tembotrione at 110g a.i/ha$^{-1}$, post-em (30 DAS) | 49.46 | 83.33 | 132.84 |
| T2- Atrazine+ pendimethalin (1+0.75 kg/ha$^{-1}$) pre em. | 51.80 | 100.38 | 152.22 |
| T3- Atrazine 1kg/ha$^{-1}$, pre em f.b 1 HW (30DAS) | 51.33 | 97.73 | 148.92 |
| T4- Atrazine 1kg/ha$^{-1}$, pre-em f.b earthing up (45DAS) | 51.10 | 96.12 | 147.25 |
| T5- Pendimethalin 0.75 kg/ha$^{-1}$, pre-em f.b 1HW (30 DAS) | 49.70 | 84.54 | 134.11 |
| T6- Pendimethalin at 0.75 kg/ha$^{-1}$, pre-em f.b earthing up(45DAS) | 49.93 | 85.83 | 135.80 |
| T7- Atrazine 1kg/ha$^{-1}$, f.b + straw mulching | 57.63 | 116.93 | 174.40 |
| T8- Atrazine 1kg/ha$^{-1}$, pre-em f.b 2,4-D amine 0.58kg a.i/ha$^{-1}$, post-em.(30 DAS) | 50.16 | 87.84 | 137.87 |
| T9- Intercropping cowpea f.b earthing up (45 DAS) | 52.73 | 111.04 | 163.69 |
| T10- Intercropping cowpea (pendimethalin 0.75 kg/ha$^{-1}$), pre-em f.b earthing up (45 DAS) | 58.33 | 119.84 | 178.01 |
| T11- atrazine 0.33 kg/ha$^{-1}$, pre-em band application+ interculture | 52.26 | 105.87 | 158.17 |
| T12- Black plastic mulch | 51.10 | 90.86 | 141.82 |
| T13- Ridge planting | 52.03 | 101.87 | 153.76 |
| T14- Two hand weeding (3 and 5 WAS) | 58.10 | 118.09 | 176.15 |
| T15- Unweeded (control) | 39.90 | 74.17 | 114.02 |
| C.D at 5% | 4.64 | 6.98 | 8.14 |

## Conclusion

From the above discussion, it can be concluded that all the parameters were significantly influenced by different weed management methods in *kharif* maize. Treatment of intercropping of cowpea (pendimethalin 0.75 kg/ha$^{-1}$, pre-em) f.b. earthing up (45 DAS) was found to be the best treatment with lowest weed count and weed dry matter. It also recorded maximum crop growth and yield attributes. With respect to

the grain yield, maximum grain yield was recorded in intercropping of cowpea (pendimethalin 0.75 kg/ha$^{-1}$, pre-em) f.b. earthing up (45 DAS) which was at par with two hand weeding and atrazine 1.0 kg per ha$^{-1}$, pre-em f.b. straw mulching. The extent of grain yield increase in intercropping of cowpea (pendi 0.75 kh/ha$^{-1}$ pre-em) f.b earthing up 45 DAS over control was 46.19% followed by two hand weeding in which it was 45.61% and atrazine 1.0 kg per ha$^{-1}$, pre-em f.b. straw mulching with 44.43%. These treatments were significantly superior in comparison to other weed control treatments.

## References


1. Barla S, Upasani RR, Puran AN, Thakur R. Weed management in maize. Indian Journal of Weed Science. 2016;48(1):67-69.
2. Das A, Kumar M, Ramkrushna GI, Patel DP, Layek J, Panwar AS, *et al*. Weed management in maize under rainfed organic farming system. Indian Journal of Weed Science. 2016;48(2):168-172.
3. Dubey RP. Effect of weed control and nitrogen application rates on weed infestation and productivity in maize-cowpea intercropping system. Indian Journal of Weed Science. 2008;40(3&4):155-158.
4. Jamshidi K, Yousefi AR, Oveisi M. Effect of cowpea (*Vigna unguiculata*) intercropping on weed biomass and maize (*Zea mays*) yield. New Zealand Journal of Crop and Horticultural Science. 2013;41(4):180-188.
5. Kumar A, Kumar J, Puniya R, Mahajan A, Sharma N, Stanzen L. Weed management in maize-based cropping system. Indian Journal of Weed Science. 2015;47(3):254-266.
6. Kumawat N, Yadav RK, Bangar KS, Tiwari SC, Morya J, Kumar R. Studies on integrated weed management practices in maize-A review. Agricultural Reviews. 2019;40(1):29-36.
7. Nand V, Kumar R, Doharey RK, Singh MP, Verma SK. Study about the interaction effects on varieties and plant geometry on growth and yield of hybrid and composite maize (*Zea mays* L.) on *rabi* season. IJCS. 2018;6(2):2539-2544.
8. Rajeshkumar A, Venkataraman NS, Ramadass S. Integrated weed management in maize-based intercropping systems. Indian Journal of Weed Science. 2018;50**:**(1):79-81.
9. Singh AK, Parihar CM, Jat SL, Singh B, Sharma S. Weed management strategies in maize (*Zea mays*): Effect on weed dynamics, productivity and economics of the maize-wheat (*Triticum aestivum*) cropping system in Indogangetic plains. Indian Journal of Agricultural Sciences. 2015;85(1):87-92.
10. Singh A, Chand M, Punia SS. Evaluation of Different Herbicides against Complex Weed Flora in *Kharif* Maize. International Journal of Pure & Applied Bioscience. 2018;6(5):803-807.
11. Sraw PK, Kaur A, Singh K. Integrated weed management in kharif maize at farmers field in Central Punjab. International Journal of Agricultural Science and Research. 2016;6(2):97-100.
12. Suroshe SS, Chorey AB, Thakur MR. Productivity and economics of maize-based intercropping systems in relation to nutrient management. Research on Crops. 2009;10(1)38-41.
13. Talebbeigi RM, Ghadiri H. Effects of cowpea living mulch on weed control and maize yield. J Biol. Environ. Sci. 2012;6(17):189-193.