The Pharma Innovation Journal 2021; 10(10): 1417-1421

www.ThePharmaJournal.com

The Pharma Innovation

**ISSN (E): 2277- 7695**
**ISSN (P): 2349-8242**
**NAAS Rating: 5.23**
TPI 2021; 10(10): 1417-1421

www.thepharmajournal.com
Received: 19-07-2021
Accepted: 24-09-2021

**Dhivya S**
PG Student, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

**Kalpana R**
Professor, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

**Murali Arthanari P**
Associate Professor, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

**Senthil A**
Professor, Department of Crop Physiology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

**Corresponding Author:**
**Dhivya S**
PG student, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

# Effect of non-chemical weed management practices on weed dynamics and yield in organic Okra (*Abelmoschus esculentus* L.)

**Dhivya S, Kalpana R, Murali Arthanari P and Senthil A**

**Abstract**
A field experiment was carried out at Eastern block Farm of Tamil Nadu Agricultural University, Coimbatore, to study the effect of different non-chemical weed management practices on weed dynamics and fresh fruit yield of organic okra during the summer season of 2021. Treatments included of three different intercropping (sunnhemp, dhaincha, cowpea and four different organic mulches (paddy straw, corn cob and husk, sugarcane trash and groundnut shell) were compared with hand weeding and weedy check. The experiment was laid out in a randomized block design with nine treatments were replicated thrice. The study revealed that among the mulching and intercropping practices mulching with sugarcane trash @ 5t/ha with one hand weeding on 20 days after sowing was very effective in controlling weeds and recorded the lowest weed density, weed dry weight, weed index and higher weed control efficiency (86.15%) at critical crop weed competition period with higher fruit yield (19.75 t/ha). It was followed by mulching with paddy straw @ 5t/ha with one hand weeding on 20 days after sowing. Mulching and intercropping recorded lower weed density and dry weight, weed index and higher weed control efficiency compared to the weedy check.

**Keywords:** Intercropping, non-chemical weed management, okra, organic mulches, sugarcane trash and weed control efficiency

## 1. Introduction
Okra (*Abelmoschus esculentus* (L.) Moench) is one of the most popular warm-season vegetable grown in India for its fresh fruit, belonging to the Malvaceae family. Globally it is cultivated in tropical, subtropical and in the warmer parts of the temperate regions. India is the leading country in okra production having an area of 0.59 million hectares with a production of 6.09 million tonnes and productivity of 11.97 t/ha (National Horticultural board, 2018) [10].
Weed competition with the crop causes considerable yield losses of about 40-80% which rely upon the weed flora, their density and stages. The critical period of weed competition in okra was found to be between 2 to 6 weeks after sowing (Patel *et al*., 2004) [12]. Weeds in organic vegetable production are controlled by using cultural, physical, mechanical, thermal, and biological means during critical crop-weed competition. Weed persistence is more in organic farming due to the extensive usage of organic manures, which act as weed seed reservoirs (Sanbagavalli *et al.*, 2020) [16].
In organic okra cultivation, weed management aims to reduce weed competition with the crop. Because of the slow growing nature at initial stage and wider inter row spacing of the crop, heavy infestation by grasses and broad leaved weeds at early stage accounts for 70% yield loss in okra (Singh and Tripati, 1990) [17].
Scarcity of manpower at critical stage and the adverse effect of herbicides on the environment makes it imperative to develop an effective, sustainable and economical weed management practice. Mulches have mechanical and allelopathic effect on weed growth and intercrop helps to suppress weeds by usurping resources from weeds. So, these methods can be practiced as an alternative weed control method in organic system to reduce the weed growth at early stages in widely spaced crops like okra.

## 2. Materials and Methods
The field trial was carried out during the summer season 2021 (March - July) at Eastern block farm, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore. The experimental site is geographically located in the western agro climatic zone of Tamil Nadu

which lies at 11º 01' N latitude and 76º 93' E longitude with an elevation of 427 m from mean sea level. The soil was sandy clay loam in texture and slightly alkaline (pH-8.66) with low soluble salts (EC-0.24 dS/m). The nutrient status of the soil was low in organic carbon (0.39%), medium in available nitrogen (224 kg/ha), medium in available phosphorus (18.36 kg/ha) and high in available potassium (1189 kg/ha). The treatment comprised of nine weed management practices *viz.*, Intercropping with Sunnhemp and *insitu* incorporation on 30 DAS ($T_1$), Intercropping with Dhaincha and *insitu* incorporation on 30 DAS ($T_2$), Intercropping with cowpea and *insitu* incorporation on 30 DAS ($T_3$), Paddy straw mulch @ 5t/ha + one hand weeding on 20 DAS ($T_4$), Corn cob and husk mulch @ 5t/ha + one hand weeding on 20 DAS ($T_5$), Sugarcane trash mulch @ 5t/ha + one hand weeding on 20 DAS ($T_6$), Groundnut shell mulch @ 5t/ha + one hand weeding on 20 DAS ($T_7$), Hand weeding on 20 and 30 DAS ($T_8$), Weedy check ($T_9$) and were evaluated in Randomized Block Design (RBD) with three replications. TNAU Bhendi Hybrid CO 4 (10 kg/ha) seeds were dibbled at 45 × 30 cm spacing. Intercrops were sown as per treatment and incorporated on 30 DAS. Mulching was done on 5 DAS as per the treatments. Observations on weed density (absolute and relative density) were recorded with the help of 0.5 × 0.5 m quadrate and weed dry weight was assessed by oven drying weeds at 70 ºC for 72 hours. Data on weed density and dry weight were transformed through square root method before statistical analysis. Weed control efficiency was calculated as per the formula suggested by Mani *et al*. (1973) [9] and weed index as per the formula suggested by Gill and Vijaykumar (1969) [6]. Data on yield attributes and fruit yield were collected from randomly tagged five plants in each experimental plot and analysed statistically as suggested by Gomez and Gomez (1984) [7].

## 3. Result and Discussion

### 3.1. Weed Parameters

#### 3.1.1. Weed flora

Weed flora of the experimental field consisted of four, one and seven species of grass, sedge and broad leaved weeds respectively. *Cynodon dactylon, Dactyloctenium aegyptium, Echinochloa colonum, Setaria verticiliata* under grasses, *Cyperus rotundus* under sedge and *Trianthema portulacatrum, Digera arvensis, Amaranthus viridis, Boerhaavia erecta, Datura metal, Corchorus olitorius, Parthenium hysterophorus* under broad leaved weeds were observed in okra. A Similar broad spectrum of weed flora on okra was reported by Krishna *et al*., (2017) [8].

#### 3.1.2. Absolute and Relative weed density

Among the category of weeds, broad leaved weeds recorded the highest absolute (178.5 and 143.3 /m$^2$) and relative density (63.54 and 57.34%) at 15 and 30 DAS respectively (Table 1). *Trianthema portulacastrum* registered higher absolute (127.9 and 90.90 /m$^2$) and relative density (45.45, 36.07%) under broad leaved weeds and also among the weed spectrum. At 15 DAS, among grass *Setaria vertilciliata* recorded higher absolute and relative density (23.04 /m$^2$ and 8.16%) respectively and at 30 DAS. *Cynodon dactylon* registered higher absolute and relative density (33.60 /m$^2$ and 13.35%) respectively. *Cyperus rotundus* was the only sedge registered higher absolute and relative density under sedge at 15 and 30 DAS. Similar findings were reported by Ravichandran and Prabhakaran (2017) [15].

#### 3.1.3. Weed density

The results revealed (Table 2) that among the mulching and intercropping practices sugarcane trash mulch @ 5 t/ha with one hand weeding on 20 DAS significantly reduced weed density (6.24, 6.24 and 5.83 No./m$^2$) followed by mulching with paddy straw @ 5 t/ha + hand weeding on 20 DAS (8.44, 7.58 and 7.60 No./m$^2$) at 15, 30 and 45 DAS. Similar findings were reported by Ehsas *et al*. (2016) [5]. At all the stages, weed density was highest under weedy check (16.78 /m$^2$, 15.92 /m$^2$ and 14.89 /m$^2$) and lowest under weed free plot. The findings are in line with the results by Singh *et al*. (2010) [18].

**Table 1:** Absolute and relative density of weed species under non-chemical weed management practices in okra at 15 DAS and 30 DAS

| Weed species | Absolute density (No./m$^2$) | | Relative density (%) | |
|---|---|---|---|---|
| | 15 DAS | 30 DAS | 15 DAS | 30 DAS |
| **Grasses** | | | | |
| *Cynodon dactylon* | 20.28 | 33.60 | 7.13 | 13.35 |
| *Echinochloa colonum* | 19.75 | 22.52 | 7.08 | 8.90 |
| *Setaria vertilciliata* | 23.04 | 18.52 | 8.16 | 7.32 |
| *Dactyloctenium aegyptium* | 10.00 | 2.22 | 3.56 | 0.90 |
| **Total grasses** | 73.07 | 76.86 | 25.93 | 30.46 |
| **Sedges** | | | | |
| *Cyperus rotundus* | 29.47 | 33.28 | 10.52 | 13.19 |
| Total sedges | 29.47 | 33.28 | 10.52 | 13.19 |
| **Broad leaved weeds** | | | | |
| *Trianthema portulacastrum* | 127.9 | 90.90 | 45.45 | 36.07 |
| *Digera arvensis* | 13.97 | 17.11 | 5.02 | 6.49 |
| *Amaranthus viridis* | 19.39 | 17.00 | 6.90 | 6.66 |
| *Boerhaavia erecta* | 6.14 | 6.34 | 2.17 | 2.53 |
| *Datura metal* | 3.15 | 4.00 | 1.13 | 1.56 |
| *Corchorus olitorius* | 3.85 | 4.00 | 1.39 | 1.53 |
| *Parthenium hysterophorus* | 4.13 | 4.00 | 1.49 | 1.51 |
| Total broad leaved weeds | 178.5 | 143.3 | 63.54 | 57.34 |
| Total weeds | 281.0 | 253.5 | - | - |

#### 3.1.4. Weed dry weight

Sugarcane trash mulch @ 5 t/ha with one hand weeding on 20 DAS significantly reduced the dry weight (1.72 g/m$^2$) at 15 DAS, followed by paddy straw mulch @ 5t/ha + one hand

weeding on 20 DAS (2.31 g/m$^2$). At 30 DAS mulching with sugarcane trash @ 5 t/ha registered lowest weed dry weight (8.25 g/m$^2$) followed by mulching with paddy straw @ 5t/ha + one hand weeding on 20 DAS (9.88 g/m$^2$) and mulching with corn cob and husk @ 5t/ha + one hand weeding on 20 DAS (11.16 g/m$^2$). At 45 DAS, lowest weed dry weight was recorded in sugarcane trash mulch @ 5 t/ha with one hand weeding on 20 DAS followed by mulching with paddy straw @ 5t/ha with one hand weeding on 20 DAS (10.82 g/m$^2$) and intercropping with cowpea and *insitu* incorporation on 30 DAS (12.04 g/m$^2$). The effectiveness of sugarcane trash mulch to achieve weed control has been reported by Raman *et al*. (2004) [14]. Similarly, the significantly highest weed dry weight was observed in weedy check at all stages (Table 2).

**3.1.5. Weed control efficiency (WCE):** The different non-chemical weed management practices were exerted influence on weed control efficiency assessed at 15, 30 and 45 DAS (Fig. 1). Application of sugarcane trash mulch @ 5t/ha + one hand weeding on 20 DAS recorded highest WCE (86.15%, 84.84% and 84.79%) followed by paddy straw mulch @ 5 t/ha + hand weeding on 20 DAS (74.55%, 77.45% and 74.08%) at 15, 30 and 45 DAS respectively. It was due to the presence of mulch as physical barrier for germination of weed seeds which resulted in reduced weed density and dry weight. A Similar study was conducted by Vishalini *et al*. (2020) [19] stated that mulching recorded the highest WCE. Weed free plot found to have the highest WCE of 90.68% and 90.66% at 30 and 45 DAS respectively. Bajaj and Yadav (2016) [2] also found that the highest weed control efficiency was observed in hand weeding.

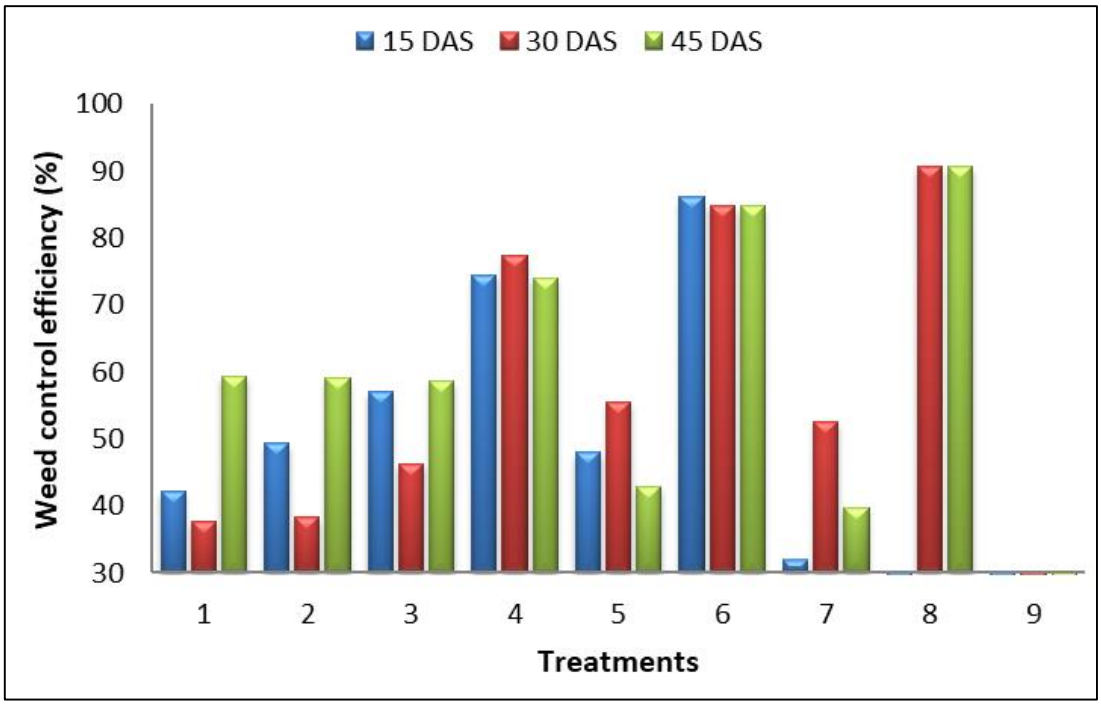


**Fig 1:** Effect of weed management practices on weed control efficiency (%) in okra

**Table 2:** Effect of non-chemical weed management practices on weed density (No./m$^2$) and weed dry weight (g/m$^2$) in okra

| Treatments | Weed density (No./m$^2$) | | | Weed dry weight (g/m$^2$) | | |
|---|---|---|---|---|---|---|
| | 15 DAS | 30 DAS | 45 DAS | 15 DAS | 30 DAS | 45 DAS |
| $T_1$- Intercropping with sunnhemp and *insitu* incorporation on 30 DAS | 12.72 (162.3) | 12.58 (158.0) | 9.51 (90.00) | 3.98 (15.30) | 13.79 (190.4) | 14.15 (200.0) |
| $T_2$- Intercropping with Dhaincha and *insitu* incorporation on 30 DAS | 11.89 (142.41) | 12.51 (156.3) | 9.53 (90.37) | 4.02 (15.68) | 14.06 (197.4) | 14.16 (200.2) |
| $T_3$- Intercropping with cowpea and *insitu* incorporation on 30 DAS | 11.00 (120.8) | 11.69 (136.1) | 9.51 (91.33) | 3.25 (10.05) | 13.79 (189.7) | 12.04 (144.6) |
| $T_4$- Paddy straw mulch @ 5t/ha + one hand weeding on 20 DAS | 8.44 (71.54) | 7.58 (57.17) | 7.60 (57.37) | 2.31 (4.82) | 9.88 (97.26) | 10.82 (116.6) |
| $T_5$- Corn cob and husk mulch @ 5t/ha + one hand weeding on 20 DAS | 12.11 (146.3) | 10.60 (112.8) | 11.25 (126.3) | 3.98 (15.69) | 11.16 (124.1) | 14.82 (219.0) |
| $T_6$- Sugarcane trash mulch @ 5t/ha + one hand weeding on 20 DAS | 6.24 (38.93) | 6.24 (38.41) | 5.83 (33.67) | 1.72 (2.45) | 8.25 (67.69) | 8.61 (73.73) |
| $T_7$ - Groundnut shell mulch @ 5t/ha + one hand weeding on 20 DAS | 13.81 (191.3) | 10.98 (120.1) | 11.56 (133.3) | 4.01 (15.95) | 11.32 (127.6) | 15.15 (229.0) |
| $T_8$- Hand weeding on 20 and 30 DAS (Weed free plot) | - | 4.82 (23.63) | 4.57 (20.67) | - | 6.37 (40.50) | 7.24 (51.97) |
| $T_9$- Weedy check | 16.78 (281.0) | 15.92 (253.5) | 14.89 (221.3) | 5.07 (25.17) | 16.61 (276.8) | 19.47 (381.0) |
| S.Ed | 0.64 | 0.57 | 0.56 | 0.26 | 0.63 | 0.65 |
| CD (P=0.05) | 1.35 | 1.20 | 1.18 | 0.56 | 1.34 | 1.37 |

### 3.1.6. Weed index (WI)
Weed index was lower in plot with sugarcane trash mulch @ 5t/ha + one hand weeding on 20 DAS (11.00%), followed by Paddy straw mulch @ 5t/ha + one hand weeding on 20 DAS (23.21%), indicating their effectiveness in weed management (Fig. 2). Weedy check recorded higher WI of 61.99%, which indicates the increased crop weed competition.

## 3.2. Yield parameters
### 3.2.1. Yield Attributes
Yield attributes in organic okra were significantly influenced by non-chemical weed management practices (Table 3). More number of fruits per plant (23.13), higher fruit length (12.40 cm), fruit girth (1.77 cm) and fruit weight (11.53 g) were recorded in sugarcane trash mulch @ 5 t/ha with hand weeding on 20 DAS. It was followed by mulching with paddy straw @ 5t/ha + one hand weeding on 20 DAS. This is in similarity with the findings of Bhobhriya *et al*. (2019) [4]. The lowest number of fruits per plant (13.17), fruit length (8.60 cm), fruit girth (1.55 cm) and fruit weight (8.65 g) was recorded in weedy check.

### 3.2.2. Fresh fruit yield
Higher fruit yield was registered in sugarcane trash mulch @ 5t/ha with one hand weeding on 20 DAS (19.75 t/ha) followed by paddy straw mulching which gave 17.04 t/ha among mulching and intercropping treatments (Table 3). These results are in confirmation with the findings of Abouziena *et al*. (2014) [1].

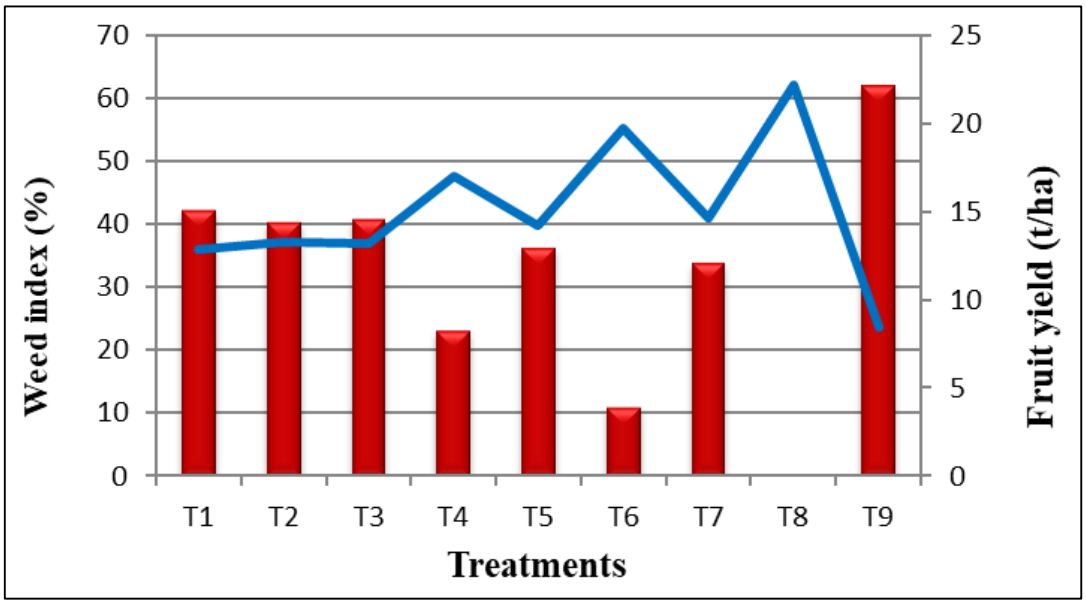


**Fig 2:** Effect of weed management practices on fruit yield and weed index in okra

**Table 3:** Effect of non-chemical weed management practices on yield attributes and fruit yield in okra

| Treatments | No. of fruits per plant | Fruit length (cm) | Fruits girth (cm) | Fruits weight (g) | Fruit yield (kg/plant) | Fruit yield (t/ha) |
|---|---|---|---|---|---|---|
| $T_1$- Intercropping with sunnhemp and *insitu* incorporation on 30 DAS | 18.60 | 9.20 | 1.63 | 9.32 | 0.174 | 12.86 |
| $T_2$- Intercropping with Dhaincha and *insitu* incorporation on 30 DAS | 18.50 | 9.40 | 1.65 | 9.65 | 0.179 | 13.24 |
| $T_3$- Intercropping with cowpea and *insitu* incorporation on 30 DAS | 18.80 | 9.48 | 1.60 | 9.45 | 0.178 | 13.17 |
| $T_4$- Paddy straw mulch @ 5t/ha + one hand weeding on 20 DAS | 20.37 | 12.20 | 1.75 | 11.29 | 0.230 | 17.04 |
| $T_5$- Corn cob and husk mulch @ 5t/ha + one hand weeding on 20 DAS | 19.03 | 10.58 | 1.60 | 10.05 | 0.191 | 14.17 |
| $T_6$- Sugarcane trash mulch @ 5t/ha + one hand weeding on 20 DAS | 23.13 | 12.40 | 1.77 | 11.53 | 0.267 | 19.75 |
| $T_7$ - Groundnut shell mulch @ 5t/ha + one hand weeding on 20 DAS | 19.23 | 11.20 | 1.66 | 10.29 | 0.198 | 14.64 |
| $T_8$- Hand weeding on 20 and 30 DAS (Weed free plot) | 25.60 | 12.83 | 1.79 | 11.72 | 0.300 | 22.23 |
| $T_9$- Weedy check | 13.17 | 8.60 | 1.55 | 8.65 | 0.114 | 8.43 |
| SEd | 1.18 | 0.25 | 0.04 | 0.26 | 0.01 | 0.98 |
| CD (P=0.05) | 2.50 | 0.52 | 0.08 | 0.55 | 0.03 | 2.08 |

Hand weeding twice (weed free plot) recorded the highest yield of 22.23 t/ha. Hand weeding twice increased the yield was also reported by Baraiya *et al*. (2017) [3] and Patel *et al*. (2017) [13]. Weedy check ($T_9$) recorded the lowest fruit yield of 8.43 t/ha was supported by Olabode *et al*. (2007) [11].

## 4. Conclusion
Among the non-chemical weed management practices studied, Sugarcane trash mulch @ 5 t/ha with one hand weeding effectively controlled the weeds and recorded higher yield. From the result of the present study, it can be concluded that mulching and intercropping can be used as a sustainable non-chemical weed management practice for controlling weeds and improving the productivity of organic okra.

## 5. Reference
1. Abouziena HF, Radwan SM. Allelopathic effects of sawdust, rice straw, bur-clover weed and cogon grass on weed control and development of onion. International Journal of ChemTech Research 2015;7:337-345.
2. Bajaj ST, Yadav K. (Effect of integrated weed management practices on weed biomass, yield and

economics of okra (*Abelmoschus esculentus* L.). Current Advances in Agricultural Sciences 2016;8(1):106-108.
3. Baraiya M, Yadav KS, Kumar S, Lal N, Shiurkar G. Effect of integrated weeds management on growth and development of Okra. The Pharma Innovation 2017;6(7):1024.
4. Bhobhriya V, Gandhi N, Loona A. Effect of different types of Mulches on yield contributing characters and yield of Okra (*Abelmoschus esculentus*). Journal of Pharmacognosy and Phytochemistry 2019;1:241-243.
5. Ehsas J, Desai LJ, Ahir NB, Joshi JR. Effect of integrated weed management on growth, yield, yield attributes and weed parameters on summer maize (*Zea mays* L.) under South Gujarat condition. International Journal of Science, Environment 2016;5(4):2050-2056.
6. Gill HS, Vijaykumar. Weed index, a new method for reporting weed control trials. India Journal of Agronomy 1969;14:96-98.
7. Gomez KA, Gomez AA. Statistical procedures for agricultural research. A Wiley Interscience's publications. John Wiley and Sons, New York, 1984.
8. Krishna RG, Ganesan E, Bharani K, Bharani A. Effect of weed management practices on weed dynamics, yield, quality parameters and economics of organic Bhendi. Madras Agricultural Journal 2017;104(10-12):340-344.
9. Mani VS, Mala ML, Gautam KC, Bhagavandas. Losses in crop yield in India due to weed growth. Pans (C) 1973;14:142-158.
10. National Horticultural Board. Department of Agriculture, Cooperation & Farmers Welfare 2018.
11. Olabode OS, Ogunyemi S, Adesina GO. Response of okra (*Abelmoschus esculentus* (L). Moench) to weed control by mulching. Journal of Food Agriculture and Environment 2007;5(3, 4):324.
12. Patel R, Patel B, Meisuriya M, Patel V. Effect of methods of herbicide application on weeds and okra [*Abelmoschus esculentus* (L.)]. Indian Journal of Weed Science 2004;36(3&4):304-305.
13. Patel TU, Zinzala MJ, Patel DD, Patel HH, Italiya AP. Weed management influence on weed dynamics and yield of summer lady's finger. Indian Journal of Weed Science 2017;49(3):263-265.
14. Raman R, Kuppuswamy G, Krishnamoorthy R. Response of organic mulching practices on weed management and yield of cotton. In 6th IFAOM-Asia scientific conference 2004, 476.
15. Ravichandran RP. Behaviour of weeds under non-chemical methods of weed management in Maize. Chemical Science Review and Letters 2017;6(23):1604-1608.
16. Sanbagavalli S, Jeeva M, Somasundaram E. Eco-friendly weed management options for organic farming: A review. The Pharma Innovation Journal 2020;9(11):15-18
17. Singh G, Tripati S. Effect of herbicides on okra (*Abelmoschus esculentus* L.) and associated weeds. Paper presented at the Biennial Conference Indian Society of Weed Science, JNKVV, Jabalpur, 1990.
18. Singh M, Prabhukumar S, Sairam CV. Integrated weed management in okra (*Abelmoschus esculentus* (L.) Moench). Annals of Plant Protection Sciences 2010;18(2):481-483.
19. Vishalini R, Rajakumar D, Joseph M, Gomathy M. Efficient non-chemical weed management strategy for irrigated finger millet (*Eleusine coracana* L.). Journal of Pharmacognosy and Phytochemistry 2020;9(5):1210-1212.