# Weed Specie Composition And Diversity As Influenced By Poultry Manure Rates And Weeding Frequency In Okra

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**Abstract:** Yield losses in okra are often aggravated by the soil fertility status, weed types and degree of infestation on the field. Field trials were conducted during the early and late wet seasons of 2012 to investigate the influence of poultry manure rates and weeding regime on weed species composition and weed species diversity in okra. The experiment was arranged in a split- plot fitted into a Randomized Complete Block Design with three replicates. The main plot consisted of five poultry manure rates (0, 5, 10 and 15 t ha$^{-1}$) while the sub plots were five weeding regimes namely: weedy check, weeding at 3 weeks after sowing (WAS); weeding at 3 and 6 WAS; weeding at 3, 5 and 7 WAS and weeding at 3, 6 and 9 WAS. Data were collected on weed specie composition, growth and yield of okra. Data collected were subjected to ecological analysis and analysis of variance as appropriate and significant treatment means were separated using Duncan Multiple Range test at $p < 0.05$. The result shows that thirteen (13) and seventeen (17) weed species were observed in the early and late wet seasons respectively with broadleaves being the most prevalent. In the early wet season weed species diversity (Shannon index H') (WDI) were mostly reduced in plots weeded 3, 6 and 9 WAP) while the greatest WDI reduction was recorded in plots weeded 3, 5 and 7 WAP. WDI was greater in late wet season than early wet season. Weed dry weights were negatively and significantly correlated with total fruit yield (r = -0.81 and -0.90) in both early and late wet season respectively. It is therefore concluded that weed types and intensity could be influenced by manure rates and weeding regimes in okra.
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## 1.0 Introduction

Okra (*Abelmoschus esculentus* (L.) Moench) is a widely cultivated fruit vegetable found in almost every market in Nigeria (Akoroda *et al.*, 1985) and Africa (Schippers, 2000). It is a fast growing annual crop belonging to the family Malvaceae (George, 1999). It is a widely cultivated vegetable crop and very important in the diet of Africans (Omotoso and Shittu, 2008). It is a valuable crop that provides an excellent income and generates other opportunities for small-scale farmers (Selleck and Opena, 1985). Indeed, it is one of the important nutritional vegetable crops cultivated in Nigeria, covering an estimated land area of 1-2 million hectares (FMAWR&RD, 1989). In Nigeria, the widely cultivated okra is distributed and consumed either fresh (usually boiled, sliced or fried) or in a dried form (Fatokun and Chedda, 1983). It is an important source of protein, minerals, vitamins and roughage for those population that include it as part of their diet (Rashid *et al.,* 1999). The seeds contain about 20% protein similar to amino acid composition of soybean protein and 20% oil (similar in fatty acid composition to cotton seed oil) (Siemonsma and Hamon, 2002). Okra flowers can be very attractive and sometimes used in decorating the living rooms (Schippers, 2000). It can also be used as a plasma replacement or blood volume expander. (Agunloye, 1989).

In spite of the major significance of okra in nutritional and medicinal values, the improvement of the production of this crop have not been properly addressed. In Nigeria, the major limiting factors in okra production and other vegetables among others include weed management, tillage practices, low yielding varieties and sub-optimal planting density (Adejonwo *et al.* 1989; Burnside, 1993; Dikwahal *et al*. 2006, Adeyemi *et al*, 2008). The problem of weed infestation in okra could be influenced by the weed specie composition, diversity and the inherent fertility of the soil. This in turn will be determined by the period during which cropping takes place and environmental condition under which the crop is grown. It is worth noting that regardless of the cropping pattern (mono or intercropped) weed infestation still persists in okra production. The high intensity of weeds could be further aggravated by the inability of the crop to form adequate canopy before the flush of weeds. Such effects may be direct or indirect and the degree of competition encountered by an individual crop depends among others on the spacing, fertility of the soil, species of weeds associated as well as other climatic factors. Substantial evidence has shown that when weeds interfere with vegetables like okra it affects their vegetative and reproductive growth. The time of weed removal is therefore as important as the removal itself. It has been documented that weed shifts occur in continuously cultivated land depending on intensity and type of tillage practice, cropping systems, weed control and other changes in the habitat (Smith and Akande 2000).In the same vein, increase or decrease soil fertility status could be major determinant of the wed flora and the performance of a cultivated crop. Previous research work conducted on the weed management in okra has placed little emphasis on the weed specie composition and diversity in okra production under different different fertility status and management. The objective of this study therefore was to assess the weed specie and diversity as influenced by poultry.manure rates and weeding regimes.

**2.0 Materials and Methods**

**2.1 Experimental Site**

Field experiment was conducted at the Teaching and Research Farm of Federal University of Agriculture, Abeokuta, Ogun State, Nigeria. The study area lies within 7°12' N and 30°0' E longitude with an elevation of 250 m above sea level. The experimental site lies within the forest-savannah transition agro-ecological zone of South Western Nigeria. Generally, the monthly rainfall distribution pattern for Abeokuta is bi- modal with peaks in June and September. Annual rainfall ranges from 1200 to 1450 mm spanning over eight months (March to October) with a dry spell in August (Table 1).

**2.2 Experimental Design, Treatments and Plot size.**

All treatments in different combinations were laid out in a split plot design fitted into a randomized complete block arrangement with three replications. Poultry manure rates at four levels (0, 5, 10 and 15 t $ha^{-1}$) constitute the main plot treatments while the sub plots treatments were five levels of weeding regimes viz weedy check; weeding at 3weeks after sowing (WAS); weeding at 3 and 6 WAS; weeding at 3, 5 and 7 WAS and weeding at 3, 6 and 9 WAS. The main and sub-plots area were 68 $m^2$ and 12 $m^2$ respectively

**2.3 Cultural practices**

**2.3.1 Plant Sampling**: Okra plant and weed samples were cut at soil level at full bloom, oven dried at 70°C to constant weight, weighed and milled for analysis.

**2.3.2 Soil Sampling**: Soil samples were collected at random from the site at a depth of 0-15 cm before treatment applied. The soil samples were air dried, crushed and filtered through a 2 mm sieve. Samples were then analyzed in a laboratory for their Physico – chemical properties. Soil pH, Organic carbon content, Exchangeable bases (Na, K, Ca and Mg), Potassium (K) and Sodium (Na) and available phosphorus. Similarly, chemical and physical analysis of the poultry manure (layer's droppings) obtained was carried out and the results are presented in Tables 2 and 3. The poultry manure was allowed to undergo curing before it was applied on the plots.

**2.3.3 Crop establishment**

The okra seeds used was an early maturing cultivar (LD-88 variety) sourced from NIHORT National Institute for horticultural Research, Ibadan, Oyo State. Three seeds were sown at a spacing of 0.75 m x 0.45 m on 9$^{th}$ of March (early season) and 22$^{nd}$ of August (late season) of 2012. Missing stands were supplied at 2 WAS. The okra seeds were soaked overnight in water to hasten germination.

**2.3.4 Crop maintenance**

Foliar and floral insects on the okra plants were controlled weekly with Dichlorvos at 1.0 litre a.i/ha starting from 3 WAS until flowering. Weeding was carried out according to the treatments using West African hand hoe.

**2.4 Data collection**

Data collection commenced at three (3) WAS and was carried out fortnightly until 12 WAS. These sampling periods covered the active vegetative development, anthesis and physiological maturity in okra. Data were collected on weed parameters, growth parameters, yield parameters and dry matter components as described below.

**2.5 Weed sample collection and biomass determination**

Samples of weeds within 0.5 $m^2$ quadrat were collected, counted and classified based on floral morphology (broad, sedges and grasses) before the commencement of the experiment and prior to weeding treatments (Table 3).

The samples collected were separated into grasses, broadleaves and sedges before oven drying at 70$^0$C until a constant dry weight was obtained and weighed.cumulatively together at the final harvest and used to determine total weed dry matter per plot.

From the weed density, the relative weed density (RD) and relative weed frequency (RF) were determined. Weed species richness were determined by measuring the weed species diversity using Shannon Weiner index (*H'*) = -Σpilnpi, where pi can be estimated in proportion as ni/N. Where ni is the number of individuals weed species in a quadrat and N is the total number of weed species in the quadrat. By definition the 'pi' will be between 0 and 1 (Magurran, 1988). The Relative Importance Value (RIV) of weeds was calculated from the equation: RF +RD/2, where RF= relative frequency of weed occurrence and RD= relative weed density, according to Wentworth *et al*. (1984).

$$RD = \frac{\text{Density of a particular species} \times 100}{\text{Density of all species}}$$

$$RF = \frac{\text{Number of occurrence of a particular species} \times 100}{\text{Total of occurrence of all species}}$$

$$RIV = \frac{\text{Relative density} + \text{Relative Frequency}}{2}$$

At harvest, laboratory chemical analysis was carried out on the okra pods and weeds to determine the nutrient content.

### 2.6 Data Analysis

Data collected were subjected to analysis of variance (ANOVA) at 5% probability level and treatment means were separated using Duncan's Multiple Range Test (DMRT). Count data were transformed using square root transformation. Correlation analysis was carried out to determine the relationship among the weed weight, growth and yield parameters.

## 3.0 Results and Discussion

### 3.1 Agro climatological Data of the Experimental Site.

The rainfall is bimodal with peaks in June and October. The minimum and maximum temperature was recorded in July and March respectively with the Relative humidity ranging between 70.5 to 82.6 % (Table 1).

### 3.2 Initial Soil and Poultry manure analysis.

The soil was sandy loam with pH of 5.46 and 5.37 in the early and late seasons respectively (Tables 2 and 3). The organic carbon, Total nitrogen were high er in the late season than the early season. However, the available P decreased from 6.60 to 4.70 mg/kg while K, Ca and Na were enhanced in the late season compared to the early season.

**Table 1: Mean monthly temperature, rainfall, relative humidity and sunshine at Alabata in 2012**

| Month of 2012 | Rainfall (mm) | Temperature ($^0$c) | Humidity (%) | Sunshine (hrs) |
|---|---|---|---|---|
| **January** | 0.00 | 27.0 | 75.2 | 4.2 |
| **February** | 67.2 | 28.8 | 70.5 | 4.5 |
| **March** | 67.7 | 29.1 | 79.3 | 5.1 |
| **April** | 80.1 | 28.5 | 79.5 | 5.7 |
| **May** | 115.3 | 27.7 | 77.3 | 4.8 |
| **June** | 225.1 | 26.9 | 78.7 | 3.9 |
| **July** | 155.4 | 26.0 | 78.7 | 3.9 |
| **August** | 36.4 | 25.5 | 80.9 | 4.0 |
| **September** | 181.4 | 26.2 | 82.6 | 2.7 |
| **October** | 184.7 | 27.2 | 76.0 | 4.0 |
| **November** | 49.6 | 28.2 | 77.5 | 5.7 |
| **December** | 1.3 | 28.8 | 81.9 | 5.4 |

**Table 2: Initial soil and poultry manure analysis for early wet season**

| **Physico- chemical properties** | **Soil** | **Poultry manure** |
|---|---|---|
| Sand g/kg | 844.00 | |
| Silt g/kg | 62.00 | |
| Clay g/kg | 94.00 | |
| Textural class | Sandy loam | |
| Soil pH($H_2O$) | 5.46 | 5.84 |
| Organic C (%) | 1.04 | 4.28 |
| Total N (%) | 0.70 | 1.04 |
| Av.P (mg /kg) | 6.60 | 5.08 ($P_2O_5$) |
| **Exchangeable Bases** K (cmol/kg) | 0.54 | 29.00 ($K_2O$) |
| Ca (cmol /kg) | 0.43 | 4.20 |
| Na (cmol /kg) | 1.29 | 2.95 |
| Mg (cmol /kg) | 4.08 | 9.63 |
| Exchangeable acidity (cmol /kg) | 0.74 | 0.12 |
| ECEC (mg/kg) | 7.08 | 26.90 |
| **Exchangeable Micronutrients** Mn (mg/kg) | 20.75 | 667.5 |
| Zn (mg/kg) | 3.70 | 114.50 |
| Cu (mg/kg) | 1.95 | 3.45 |
| Fe (mg/kg) | 79.00 | 410.00 |

**Table 3: Initial soil and poultry manure analysis for late wet season**

| Physico- chemical properties | Soil | Poultry manure |
|---|---|---|
| Sand g/kg | 684.00 | |
| Silt g/kg | 44.00 | |
| Clay g/kg | 82.00 | |
| Textural class | Sandy loam | |
| Soil pH ($H_2O$) | 5.37 | 5.68 |
| Organic C (%) | 2.03 | 3.97 |
| Total N (%) | 1.10 | 2.01 |
| Av.P (mg /kg) | 4.70 | 3.34 ($P_2O_5$) |
| | | |
| **Exchangeable Bases** | 0.94 | 28.65 ($K_2O$) |
| K (cmol/kg) | | |
| Ca (cmol /kg) | 5.05 | 3.90 |
| Na (cmol /kg) | 1.32 | 2.93 |
| Mg (cmol /kg) | 7.54 | 9.52 |
| Exchangeable acidity (cmol /kg) | 0.14 | 0.09 |
| ECEC (mg/kg) | 14.99 | 26.50 |
| | | |
| **Exchangeable Micronutrients** | 73.00 | 672.00 |
| Mn (mg/kg) | | |
| Zn (mg/kg) | 12.75 | 110.00 |
| Cu (mg/kg) | 2.60 | 3.35 |
| Fe (mg/kg) | 37.50 | 430.00 |

**3.3 Effect of Poultry manure Rates and weeding regimes on the Relative Weed Abundance.**

The relative weed abundance was determined by calculating the Relative importance value (RIV) of weed species (Tables 4 to 7). The RIV is the summation of Relative weed density and Relative weed frequency divided by two. Thirteen (13) and seventeen (17) weed species were identified in the okra plots in the early and late wet season respectively. *Urena lobata* and *Tridax procumbens* accounted for over 15% of the weed species in early and late wet season at different poultry manure rates.

*Urena lobata* recorded the highest relative density (RD) of 21.17%, 21.48%, 18.86% and 15.24% in plots treated with 0, 5, 10 and 15 t ha$^{-1}$ poultry manure respectively and occurred in plots weeded at 3 WAS throughout the trial. *Cyperus rotundus, Mariscus alternifolius, Mucuna pruriens* and *Panicum maximum* had relative densities below or ≤5% across the weeding treatments. The lowest RD (≤2%) occurred with *Cyperus rotundus* on plots weeded at 3, 5 and 7 WAS in all the poultry manure treatments.

Relative frequency is a good indicator of species distribution at a given site. In the early wet season trial, all the weeds -except *Cyperus rotundus, Mariscus alternifolius and Mucuna pruriens* occurred at a relative frequency (RF) ≥5% for various weeding regime treatments and in plots without poultry manure. However six (6) weed species (*Corchorus olitorius, Phyllanthus amarus, Senna obtusifollia, Synedrella nodiflora, Tridax procumbens and Urena lobata)* recorded the highest relative frequency (RF) 10.79% in plots without poultry manure and plots weeded at 3, 6 and 9 WAS. On weedy check plots all the weeds had the same values of RF. In plots treated with 5 t ha$^{-1}$ poultry manure and weeded at 3, 6 and 9 WAS, four (4) weed species (*Corchorus olitorius, Phyllanthus amarus, Synedrella nodiflora, and Tridax procumbens*) recorded the highest RF (10.75%). Whereas weeds like *Cyperus rotundus* and *Mucuna pruriens* had a RF ≤5% compared to other weeds in plots weeded at 3 WAS and plots weeded at 3 and 6 WAS. In plots treated with 10 t ha$^{-1}$ poultry manure and weeded at 3, 6 and 9 WAS, five weed species (*Corchorus olitorius, Phyllanthus amarus, Synedrella nodiflora, Tridax procumbens* and *Urena lobata*) recorded the highest realative frequency (10.44%). *Mucuna pruriens* and *Cyperus rotundus* recorded a lower RF ≤5% in plots weeded at 3 WAS and weeded at 3 and 6 WAS respectively. In plots treated with 15 t ha$^{-1}$ poultry manure, all the weeds except *Cyperus rotundus* and *Mucuna pruriens* recorded RF ≥5%. Very low RF occurred in plots weeded once at 3 WAS, twice at 3 and 6 WAS, thrice at 3, 5 and 7 WAS and 3, 6 and 9 WAS for *Cyperus rotundus* while *Mucuna pruriens* recorded a very low RF in plots weeded at 3 and 6 WAS. The highest RF (10.91%) was recorded in plots weeded at 3, 6 and 9 WAS with three weed species (*Phyllanthus amarus, Senna obtusifollia* and *Tridax procumbens*) recording this value. Weedy check plots recorded same value of RF (7.69%) in all the poultry manure treatments. In the late wet season trial, all weeds except *Merremia aegyptia, Mucuna pruriens , Mimosa pudica, Andropogon tectorum* and *Mariscus alternifolius* recorded a relative frequency (RF) of ≥5% in plots weeded at 3, 6 and 9 WAS, 3, 5 and 7 WAS, 3 and 6 WAS and plots weeded at 3 WAS in all the poultry manure rates (0,5,10 and 15t $ha^{-1}$) plots. The highest RF of 10.17% was recorded from *Aspillia africana* in plots weeded at 3, 6 and 9 WAS and plots treated with 10 t $ha^{-1}$ poultry manure. However weed infested plots had a constant RF value of 5.88% in plots treated with 0, 5, and 15 t $ha^{-1}$ poultry manure and 6% in plots treated with 10 t $ha^{-1}$ poultry manure, except for *Mimosa pudica* that had 4% Relative frequency

Relative Importance Value (RIV) is the most comprehensive indicator of phytosociology of a habitat. *Urena lobata* recorded the highest RIV (15.25%) in the early wet season in plots weeded at 3 WAS and plots treated with 5 t $ha^{-1}$ poultry manure (Table 4). The least Relative Importance Value occurred with *Cyperus rotundus* in plots weeded at 3, 5 and 7 WAS., while in the late season *Tridax procumbens* and *Aspillia africana* showed dominance in all the weeding regimes and poultry manure treatment plots with RIV ≥10%. *Ageratum conyzoides* and *Amaranthus spinosus* had RIV ≥10% in plots weeded at 3, 5 and 7 WAS and plots weeded at 3, 6 and 9 WAS respectively. In all the poultry manure rates and weeding regimes plots, *Mucuna pruriens , Mimosa pudica* and *Andropogon tectorum* recorded RIV of ≥5%. (Table 4, 5 6 and 7)

The highest Relative Importance Value of 15.19% was recorded in plots weeded at 3 WAS and plots treated with 5 t $ha^{-1}$ poultry manure.

The data on the specie richness and diversity (Table 8) showed that weed removal at 3, 5 and 7 WAP had the least in all the manure rates except in the early season under 5 t/ha and 10 t/ha while weedy check gave the highest weed specie richness. In the early wet season, the minimum Shannon index (2.312) was obtained in plots weeded at 3, 6 and 9 WAS and plots treated with 5 and 10 t $ha^{-1}$ poultry manure. In the late wet season, the minimum Shannon index (2.28 and 2.31) were recorded in plots weeded at 3, 5 and 7 WAS and plots treated with 0 and 10 t $ha^{-1}$ poultry manure respectively. The Shannon index values ranges from 2.31 - 2.49 in the early wet season and ranges from 2.28 - 2.68 in the late wet season. Weed species diversity was greater in the late wet season than early wet season with different application of poultry manure rates and weeding regimes. Generally, weed diversity increases as weed species richness and evenness increases in both seasons

Generally, the values of Shannon Index (H') in all the weeding treatment for both trials were >2 which implies that weed diversity is high at different rates of poultry manure application. The weedy check plots not only have a greater number of weed species present, but the individual weed species in the weedy check plots are distributed more equitably among the weed species than other weeding treatments at different rates of manure application.

The effects of poultry manure rates and weeding regime on broadleaves, grasses, sedges and total weed dry weight in okra in early wet season is shown in Table 9. There were significant differences among the grasses, broadleaves, and sedges composition with respect to different weeding regimes in early and late seasons. The effects of poultry manure rates were only significant on broadleaves dry weight in the early wet season. Plots treated with 15 t $ha^{-1}$ poultry manure recorded significant ($p<0.05$) higher broadleaves dry weight (2682.51 kg $ha^{-1}$) than other treatments.

Weeding regimes had significant effect on the population of broadleaves, grasses and sedges in the early and late wet season Weeding at 3, 6 and 9 WAS significantly reduced the population of broadleaves, grasses and sedges compared to the maximum obtained from the weed infested plots. The population of broadleaves, grasses and sedges were similar in the early season in plots weeded at 3, 5 and 7 WAS and plots weeded at 3, 6 and 9 WAS.

In the late wet season population of broadleaves varied significantly with the frequency of weeding. The population of grasses were similar in the plots weeded thrice at 3, 5 and 7 WAS and plot weeded thrice at 3, 6 and 9 WAS, but were drastically reduced compared to the plots not weeded, plot weeded once at 3 WAS and plot weeded at 3 and 6 WAS.

Also in the late wet season, weeding frequencies significantly reduced the population of sedges compared to early wet season. The population of sedges in the plots weeded twice at 3 and 6 WAS were similar to plot weeded thrice at 3, 5 and 7 WAS and plots weeded 3, 6 and 9 WAS.

**3.4 Correlations among growth, yield and yield components of okra in early and late seasons of 2012.**

Table 10 and 11 showed the correlations among yield and yield components of okra in the early and late season. In both trials, 100 seed weight, percentage survival, chlorophyll content, shoot dry weight, stand count, plant height, number of leaves, fruit length, fruit girth as well as fruit count were all significant and positively correlated with fruit yield. In addition, days to 50 % flowering was significant and positively correlated to fruit yield in the late wet season trial, while in the early wet season days to first flowering was not significant but positively correlated with fruit yield. However, days to 100 percent flowering, weed cover score and total dry weed weight were significant and negatively correlated with okra fruit yield in both trials as well as 50 days to flowering in the early wet season and first day to flowering in the late wet season.

In both seasons, weed cover score was significant and negatively correlated to stand count, plant height, number of leaves, fruit length, and fruit girth as well as fruit count. However weed cover score was significant and positively correlated with days to 100 percent flowering and total dry weed weight in both seasons, as well as days to first flowering in the late wet season and days to 50 % flowering in the early wet season. Furthermore, total weed dry weight in both seasons was also significant and negatively correlated to stand count, plant height, number of leaves, fruit length, and fruit girth as well as fruit count. The higher the weed dry weight, the lower the stand count, plant height, number of leaves, fruit length and fruit girth Weed dry weights were negatively and significantly correlated with total fruit yield (r = -0.81 and -0.90) in both early and late wet season respectively. It is therefore concluded that weed types and intensity could be influenced by manure rates and weeding regimes in okra.

**Discussion**

Total weed dry weight significantly affected the performance of okra plants. Early wet season was observed to record a higher total weed dry weight than late wet season across weeding regimes treatment. Weed interference/infestation in both seasons decreased as the number weedings increased. The control (weedy check) plots recorded the highest total weed weight while plots weeded at 3, 6 and 9 WAS recorded the least. The richness and eveness of weed species in the weedy check plots might be as a result of the okra plots not weeded throughout and other environmental factors such as rainfall, temperature and soil fertility which might bring about germination from dormancy, and increase weed population. This observation was similar to the findings of Tottman and Wilson (1990) who reported that composition and abundance of weed species in crop field depend on weed infestation, cropping systems and cultural practices.

Early wet season trial had lower weed species diversity with thirteen (13) different weed species compared to seventeen (17) in the late wet season with broadleaves being the most prevalent. The increase in weed species in late wet season might be attributed to some weed species which are dormant in the early wet season, which eventually emerged in the late wet season. This finding is similar to the earlier report of Adigun *et al.* (1992) when they reported that most weed species exhibit various degrees of dormancy before germination. Similar weeds found in both seasons were *Imperata cylindrica, Mariscus aIternifolius, Phyllanthus amarus, Synedrella nodiflora* and *Tridax procumbens*. The absence of some weed species in either of the season might be due to climatic change and weed dispersal.

Weeding regimes had significant effect on weed cover scores at 8 and 10 WAS in the growth stages of the okra cultivars. Okra plants on plots weeded at 3, 6 and 9 WAS

recorded the lowest weed cover score while the highest weed cover score was recorded in weed infested plots. This is an indication that weed infestation is higher in unweeeded plots and significantly reduces the growth and yield of okra compared to weeded plots.

Six (6) weed species: *Corchorus olitorius, Phyllanthus amarus, Senna obtusifollia, Synedrella nodiflora Tridax procumbens* and *Urena lobata* had the highest relative frequency (10.79%) in the early wet season. This was recorded in plots weeded at 3, 6 and 9 WAS and plots treated with 0 t $ha^{-1}$ poultry manure. The highest relative density (21.48%) and Relative Importance Value (15.25%) occurred with *Urena lobata* and were both recorded in plots weeded at 3 WAS plots treated with 5 t $ha^{-1}$ poultry manure in the early wet season. *Aspillia africana* recorded the highest relative frequency (10.17%) in the late wet season, and in plots treated with 10 t $ha^{-1}$ poultry manure and plots weeded at 3, 6 and 9 WAS. *Tridax procumbens* recorded the highest relative frequency (RF) of 22.42% and Relative Importance Value (RIV) of 15.19% in plots treated with 5 t $ha^{-1}$ poultry manure and plots weeded at 3 WAS. It is thus obvious that broadleaves were more dominant in this study especially in the early season. The predominant of *Urena lobata* at the expense of the grasses could be as a result of the inherent fertility of the soil and the the fact that the plot had been left to fallow for about four years. Urena lobata has been described as an aggressive invasive and noxious plant (Randall, 2012). Greater RF and RIV recorded in early wet season might be attributed to environmental factors like availability of water throughout the growing period which aids germination of weed seeds from dormancy.

The weed diversity as indicated by Shannon Weiner function (H') value > 2, which indicates a high weed diversity in all the treatments applied with weedy check plots producing the maximum weed diversity in the early and late wet season. The differential weed specie composition and diversity subjected to various manure rates and weeding frequencies could be linked with the climatic conditions of this ecology. Stephen 1982 reported that changes in the relative abundance of different weed specie or of sub specific variants can be caused by interplay of management and climatic factors including crop rotation, sowing date, timing and nature of cultivation, by liming and manuring and also by the action of herbicides. This might also account for the higher weed specie obtained in the late wet season than the early wet season. Weed species diversity was greater in the late wet season than early wet season with different application of poultry manure rates and weeding regimes. Generally, weed diversity increases as weed species richness and eveness increases in both seasons. This findings agrees with the report of Maguran (2004) that Shannon index increases as both the richness and evenness of the community

Weed dry weights were negatively and significantly correlated with total fruit yield (r = -0.81 and -0.90) in both early and late wet season respectively.

## 4.0 Conclusion

Weeds have greater genetic diversity than crops (Naidu and Murthy 2014). Consequently if the availability of a resource changes within the environment which of couse could be due to the presence of one yield limiting weed species it is possible that weeds will show a greater growth , suppression and reproductive response. (Trumble 2013). This study has showed that weeding frequencie and It is therefore concluded that weed types and intensity could be influenced by manure rates and weeding regimes in okra.

**Table 4: Effects of weeding regimes on Relative Importance Value of weeds in okra without the application of poultry manure in the early and late wet seasons of 2012**

| **Weed species** | **Weedy check** | | **3 WAS** | | **3&6 WAS** | | **3,5&7 WAS** | | **3,6&9 WAS** | |
|---|---|---|---|---|---|---|---|---|---|---|
| **0 t ha$^{-1}$** | E | L | E | L | E | L | E | L | E | L |
| *Tridax procumbens* (L.) | 8.81 | 11.14 | 10.62 | 15.17 | 10.34 | 12.34 | 10.71 | 14.24 | 11.53 | 12.52 |
| *Aspilia africana* (Pers.) | 0.00 | 9.70 | 0.00 | 11.88 | 0.00 | 11.36 | 0.00 | 13.13 | 0.00 | 10.70 |
| *Amaranthus spinosus* (L.) | 0.00 | 7.25 | 0.00 | 8.56 | 0.00 | 8.30 | 0.00 | 10.44 | 0.00 | 9.82 |
| *Ageratum conyzoides* (L.) | 0.00 | 6.02 | 0.00 | 7.12 | 0.00 | 7.96 | 0.00 | 9.07 | 0.00 | 11.16 |
| *Euphorbia heterophylla* (L.) | 0.00 | 6.02 | 0.00 | 7.95 | 0.00 | 5.80 | 0.00 | 5.31 | 0.00 | 6.80 |
| *Chromolaena odorata* (L.) R.M Kings | 0.00 | 6.43 | 0.00 | 6.84 | 0.00 | 6.99 | 0.00 | 4.72 | 0.00 | 7.69 |
| *Spigellia anthelmia* (L.) | 6.99 | 5.20 | 8.02 | 4.95 | 8.28 | 5.56 | 8.94 | 8.34 | 6.58 | 5.10 |
| *Synedrella nodiflora* (L.) J.Gaertner | 7.49 | 6.02 | 8.67 | 4.26 | 8.05 | 6.23 | 9.27 | 6.99 | 9.81 | 7.30 |
| *Merremia aegyptia* (L.) Urb. | 0.00 | 4.17 | 0.00 | 1.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Phyllanthus amarus* Sch. Thann | 7.49 | 4.79 | 6.63 | 6.95 | 7.55 | 4.21 | 7.09 | 2.87 | 10.10 | 4.23 |
| *Mucuna pruriens* (L.) | 6.35 | 4.79 | 3.00 | 2.64 | 1.95 | 1.89 | 0.00 | 0.00 | 0.39 | 1.31 |
| *Mimosa pudica* (L.) | 0.00 | 4.79 | 0.00 | 2.36 | 0.00 | 3.29 | 0.00 | 0.00 | 0.00 | 1.73 |
| *Andropogon tectorum* (L.) | 0.00 | 3.76 | 0.00 | 0.00 | 0.00 | 4.80 | 0.00 | 0.00 | 0.00 | 1.73 |
| *Corchorus olitorius*(L.) | 6.35 | 0.00 | 8.86 | 0.00 | 7.05 | 0.00 | 8.92 | 0.00 | 10.01 | 0.00 |
| *Senna obtusifollia* (L.) | 10.97 | 0.00 | 11.50 | 0.00 | 13.44 | 0.00 | 11.77 | 0.00 | 11.64 | 0.00 |
| *Talinum triangulare* (Jacq.) | 8.81 | 0.00 | 7.61 | 0.00 | 7.60 | 0.00 | 8.18 | 0.00 | 7.48 | 0.00 |
| *Urena lobata* (L.) | 12.13 | 0.00 | 15.24 | 0.00 | 13.75 | 0.00 | 13.80 | 0.00 | 14.89 | 0.00 |
| *Commelina benghalensis* (L.) | 0.00 | 4.79 | 0.00 | 4.02 | 0.00 | 3.89 | 0.00 | 6.95 | 0.00 | 3.67 |
| *Panicum maximum* (Jacq.) | 6.35 | 5.40 | 4.94 | 7.20 | 5.15 | 6.45 | 5.20 | 9.60 | 6.17 | 7.54 |
| *Imperata cylindrica* (L.) P.Beauv. | 6.50 | 4.58 | 8.53 | 5.90 | 7.34 | 7.23 | 8.96 | 8.39 | 8.29 | 7.90 |
| *Mariscus alternifolius* (Vahl.) | 6.00 | 5.20 | 3.37 | 2.64 | 7.51 | 3.72 | 6.06 | 0.00 | 3.19 | 1.73 |
| *Cyperus rotundus* (L.) | 5.83 | 0.00 | 3.11 | 0.00 | 2.30 | 0.00 | 1.17 | 0.00 | 0.00 | 0.00 |

WAS – weeks after sowing, E – early wet season, L – late wet season

**Table 5: Effects of weeding regimes on Relative Importance Value of weeds in okra with the application of 5 t ha$^{-1}$ poultry manure in the early and late wet seasons of 2012**

| Weed species | Weedy check | | 3 WAS | | 3&6 WAS | | 3,5&7 WAS | | 3,6&9 WAS | |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 t ha$^{-1}$ | E | L | E | L | E | L | E | L | E | L |
| *Tridax procumbens* (L.) | 9.07 | 11.97 | 9.99 | 15.19 | 8.75 | 11.26 | 10.83 | 13.33 | 11.68 | 11.87 |
| *Aspilia africana* (Pers.) | 0.00 | 10.13 | 0.00 | 11.69 | 0.00 | 10.97 | 0.00 | 13.08 | 0.00 | 10.82 |
| *Amaranthus spinosus* (L.) | 0.00 | 6.96 | 0.00 | 7.89 | 0.00 | 8.47 | 0.00 | 9.56 | 0.00 | 9.73 |
| *Ageratum conyzoides* (L.) | 0.00 | 6.12 | 0.00 | 6.76 | 0.00 | 7.84 | 0.00 | 8.73 | 0.00 | 9.83 |
| *Euphorbia heterophylla* (L.) | 0.00 | 5.79 | 0.00 | 8.04 | 0.00 | 5.55 | 0.00 | 6.32 | 0.00 | 6.60 |
| *Chromolaena odorata* (L.) R.M Kings | 0.00 | 5.12 | 0.00 | 6.65 | 0.00 | 7.56 | 0.00 | 7.08 | 0.00 | 7.26 |
| *Spigellia anthelmia* (L.) | 6.71 | 4.78 | 8.14 | 5.00 | 7.65 | 5.83 | 9.28 | 6.67 | 8.19 | 4.62 |
| *Synedrella nodiflora* (L.) J.Gaertner | 7.38 | 5.45 | 8.17 | 3.43 | 9.78 | 6.49 | 9.46 | 7.59 | 9.91 | 7.26 |
| *Merremia aegyptia* (L.) Urb. | 0.00 | 4.28 | 0.00 | 2.38 | 0.00 | 0.82 | 0.00 | 0.00 | 0.00 | 0.96 |
| *Phyllanthus amarus* Sch. Thann | 7.55 | 5.12 | 7.78 | 7.07 | 7.71 | 5.50 | 6.02 | 4.00 | 9.98 | 5.13 |
| *Mucuna pruriens* (L.) | 6.37 | 4.45 | 2.91 | 2.91 | 1.95 | 1.28 | 0.00 | 0.00 | 0.00 | 0.93 |
| *Mimosa pudica* (L.) | 0.00 | 4.62 | 0.00 | 2.35 | 0.00 | 3.02 | 0.00 | 0.00 | 0.00 | 1.45 |
| *Andropogon tectorum* (L.) | 0.00 | 4.11 | 0.00 | 0.00 | 0.00 | 3.98 | 0.00 | 0.00 | 0.00 | 2.00 |
| *Corchorus olitorius*(L.) | 6.37 | 0.00 | 8.56 | 0.00 | 7.71 | 0.00 | 8.71 | 0.00 | 10.01 | 0.00 |
| *Senna obtusifollia* (L.) | 11.59 | 0.00 | 11.83 | 0.00 | 11.71 | 0.00 | 12.87 | 0.00 | 11.26 | 0.00 |
| *Talinum triangulare* (Jacq.) | 8.90 | 0.00 | 7.43 | 0.00 | 7.34 | 0.00 | 9.48 | 0.00 | 8.31 | 0.00 |
| *Urena lobata* (L.) | 11.42 | 0.00 | 15.25 | 0.00 | 13.29 | 0.00 | 12.73 | 0.00 | 13.56 | 0.00 |
| *Commelina benghalensis* (L.) | 0.00 | 6.79 | 0.00 | 4.12 | 0.00 | 4.17 | 0.00 | 6.17 | 0.00 | 3.82 |
| *Panicum maximum* (Jacq.) | 6.20 | 4.95 | 6.41 | 6.86 | 5.91 | 6.77 | 4.57 | 9.64 | 6.44 | 7.98 |
| *Imperata cylindrica* (L.) P.Beauv. | 6.54 | 4.45 | 6.50 | 6.20 | 8.48 | 6.82 | 8.87 | 7.88 | 6.41 | 7.82 |
| *Mariscus alternifolius* (Vahl.) | 6.04 | 4.95 | 4.09 | 3.68 | 7.71 | 3.71 | 6.06 | 0.00 | 4.36 | 2.00 |
| *Cyperus rotundus* (L.) | 5.87 | 0.00 | 3.00 | 0.00 | 2.03 | 0.00 | 1.17 | 0.00 | 0.00 | 0.00 |

WAS – weeks after sowing, E – early wet season, L – late wet season

**Table 6: Effects of weeding regimes on Relative Importance Value of weeds in okra with the application of 10 t ha$^{-1}$ poultry manure in the early and late wet seasons of 2012**

| Weed species | Weedy check | | 3 WAS | | 3&6 WAS | | 3,5&7 WAS | | 3,6&9 WAS | |
|---|---|---|---|---|---|---|---|---|---|---|
| 10 t ha$^{-1}$ | E | L | E | L | E | L | E | L | E | L |
| *Tridax procumbens* (L.) | 9.20 | 10.20 | 9.72 | 13.11 | 9.34 | 9.92 | 10.76 | 9.72 | 11.15 | 11.29 |
| *Aspilia africana* (Pers.) | 0.00 | 10.90 | 0.00 | 12.18 | 0.00 | 10.66 | 0.00 | 10.55 | 0.00 | 11.08 |
| *Amaranthus spinosus* (L.) | 0.00 | 7.21 | 0.00 | 7.55 | 0.00 | 9.11 | 0.00 | 9.51 | 0.00 | 10.06 |
| *Ageratum conyzoides* (L.) | 0.00 | 6.34 | 0.00 | 6.63 | 0.00 | 7.80 | 0.00 | 9.28 | 0.00 | 8.66 |
| *Euphorbia heterophylla* (L.) | 0.00 | 5.99 | 0.00 | 7.55 | 0.00 | 9.11 | 0.00 | 9.51 | 0.00 | 10.06 |
| *Chromolaena odorata* (L.)R.M Kings | 0.00 | 5.28 | 0.00 | 7.18 | 0.00 | 6.21 | 0.00 | 7.95 | 0.00 | 8.03 |
| *Spigellia anthelmia* (L.) | 6.61 | 4.93 | 7.74 | 5.24 | 7.80 | 5.32 | 9.40 | 6.75 | 8.31 | 5.07 |
| *Synedrella nodiflora* (L.) J.Gaertner | 7.26 | 5.63 | 8.03 | 2.67 | 9.59 | 7.13 | 8.83 | 7.34 | 9.46 | 7.71 |
| *Merremia aegyptia* (L.) Urb. | 0.00 | 4.41 | 0.00 | 2.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Phyllanthus amarus* Sch. Thann | 7.42 | 5.28 | 7.46 | 6.63 | 6.78 | 6.67 | 5.91 | 7.15 | 9.60 | 3.54 |
| *Mucuna pruriens* (L.) | 6.28 | 4.58 | 3.59 | 3.59 | 2.56 | 1.49 | 0.00 | 0.00 | 0.00 | 1.17 |
| *Mimosa pudica* (L.) | 0.00 | 3.23 | 0.00 | 2.85 | 0.00 | 1.96 | 0.00 | 0.00 | 0.00 | 1.33 |
| *Andropogon tectorum* (L.) | 0.00 | 4.23 | 0.00 | 0.00 | 0.00 | 4.44 | 0.00 | 1.35 | 0.00 | 2.38 |
| *Corchorus olitorius*(L.) | 6.28 | 0.00 | 7.16 | 0.00 | 7.54 | 0.00 | 8.67 | 0.00 | 9.60 | 0.00 |
| *Senna obtusifollia* (L.) | 11.32 | 0.00 | 11.70 | 0.00 | 11.39 | 0.00 | 12.81 | 0.00 | 11.14 | 0.00 |
| *Talinum triangulare* (Jacq.) | 8.72 | 0.00 | 7.88 | 0.00 | 7.16 | 0.00 | 9.40 | 0.00 | 8.31 | 0.00 |
| *Urena lobata* (L.) | 12.13 | 0.00 | 14.10 | 0.00 | 13.05 | 0.00 | 13.05 | 0.00 | 14.12 | 0.00 |
| *Commelina benghalensis* (L.) | 0.00 | 7.04 | 0.00 | 5.26 | 0.00 | 4.62 | 0.00 | 6.75 | 0.00 | 3.12 |
| *Panicum maximum* (Jacq.) | 6.61 | 5.11 | 7.18 | 6.63 | 6.01 | 5.92 | 4.77 | 6.84 | 6.45 | 8.13 |
| *Imperata cylindrica* (L.)P.Beauv. | 6.45 | 4.58 | 6.59 | 6.07 | 8.44 | 6.96 | 8.97 | 7.95 | 7.31 | 8.03 |
| *Mariscus alternifolius* (Vahl.) | 5.96 | 5.11 | 4.32 | 4.05 | 7.67 | 3.73 | 6.20 | 0.00 | 4.60 | 2.38 |
| *Cyperus rotundus* (L.) | 5.79 | 0.00 | 4.60 | 0.00 | 2.69 | 0.00 | 1.27 | 0.00 | 0.00 | 0.00 |

WAS – weeks after sowing, E – early wet season, L – late wet season

**Table 7: Effects of weeding regimes on Relative Importance Value of weeds in okra with the application of 15 t ha$^{-1}$ poultry manure in the early and late wet seasons of 2012**

| Weed species | Weedy check | | 3 WAS | | 3&6 WAS | | 3,5&7 WAS | | 3,6&9 WAS | |
|---|---|---|---|---|---|---|---|---|---|---|
| **15 t ha$^{-1}$** | E | L | E | L | E | L | E | L | E | L |
| *Tridax procumbens* (L.) | 8.98 | 11.54 | 9.70 | 13.51 | 9.87 | 10.38 | 8.98 | 12.17 | 9.70 | 12.17 |
| *Aspilia africana* (Pers.) | 0.00 | 10.75 | 0.00 | 12.57 | 0.00 | 11.29 | 0.00 | 11.55 | 0.00 | 10.86 |
| *Amaranthus spinosus* (L.) | 0.00 | 7.04 | 0.00 | 7.73 | 0.00 | 7.90 | 0.00 | 9.99 | 0.00 | 9.68 |
| *Ageratum conyzoides* (L.) | 0.00 | 5.97 | 0.00 | 6.01 | 0.00 | 7.77 | 0.00 | 8.17 | 0.00 | 9.84 |
| *Euphorbia heterophylla* (L.) | 0.00 | 5.65 | 0.00 | 6.79 | 0.00 | 8.27 | 0.00 | 8.61 | 0.00 | 7.33 |
| *Chromolaena odorata* (L.) R.M Kings | 0.00 | 5.01 | 0.00 | 5.40 | 0.00 | 7.12 | 0.00 | 6.57 | 0.00 | 7.26 |
| *Spigellia anthelmia* (L.) | 6.66 | 4.69 | 7.70 | 4.77 | 7.51 | 5.38 | 6.66 | 6.18 | 7.70 | 5.44 |
| *Synedrella nodiflora* (L.) J.Gaertner | 7.32 | 5.33 | 7.11 | 5.08 | 9.25 | 5.94 | 7.32 | 7.30 | 7.11 | 7.11 |
| *Merremia aegyptia* (L.) Urb. | 0.00 | 4.38 | 0.00 | 2.61 | 0.00 | 0.68 | 0.00 | 0.00 | 0.00 | 1.27 |
| *Phyllanthus amarus* Sch. Thann | 7.49 | 5.01 | 7.70 | 6.01 | 7.25 | 5.12 | 7.49 | 3.81 | 7.70 | 4.82 |
| *Mucuna pruriens* (L.) | 6.33 | 4.38 | 3.64 | 3.24 | 2.46 | 1.35 | 6.33 | 0.00 | 3.64 | 1.11 |
| *Mimosa pudica* (L.) | 0.00 | 4.53 | 0.00 | 2.61 | 0.00 | 2.98 | 0.00 | 0.00 | 0.00 | 1.27 |
| *Andropogon tectorum* (L.) | 0.00 | 4.53 | 0.00 | 0.00 | 0.00 | 6.06 | 0.00 | 0.00 | 0.00 | 2.29 |
| *Corchorus olitorius*(L.) | 6.35 | 0.00 | 7.84 | 0.00 | 7.25 | 0.00 | 6.35 | 0.00 | 7.84 | 0.00 |
| *Senna obtusifollia* (L.) | 10.97 | 0.00 | 11.70 | 0.00 | 11.75 | 0.00 | 10.97 | 0.00 | 11.70 | 0.00 |
| *Talinum triangulare* (Jacq.) | 8.81 | 0.00 | 8.27 | 0.00 | 7.62 | 0.00 | 8.81 | 0.00 | 8.27 | 0.00 |
| *Urena lobata* (L.) | 12.79 | 0.00 | 13.84 | 0.00 | 12.62 | 0.00 | 12.79 | 0.00 | 13.84 | 0.00 |
| *Commelina benghalensis* (L.) | 0.00 | 6.60 | 0.00 | 7.12 | 0.00 | 4.46 | 0.00 | 6.94 | 0.00 | 4.27 |
| *Panicum maximum* (Jacq.) | 6.17 | 4.85 | 7.56 | 6.01 | 6.03 | 6.20 | 6.17 | 9.36 | 7.56 | 7.66 |
| *Imperata cylindrica* (L.) P.Beauv. | 6.50 | 4.69 | 6.82 | 5.85 | 8.00 | 5.92 | 6.50 | 9.36 | 6.82 | 7.66 |
| *Mariscus alternifolius* (Vahl.) | 6.00 | 5.01 | 4.37 | 4.77 | 7.37 | 3.66 | 6.00 | 0.00 | 4.37 | 0.00 |
| *Cyperus rotundus* (L.) | 5.67 | 0.00 | 3.78 | 0.00 | 3.07 | 0.00 | 5.67 | 0.00 | 3.78 | 0.00 |

WAS – weeks after sowing, E – early wet season, L – late wet season

Table 8: Weed Specie Richness and Diversity as affected Poultry manure and Weeding Regime. 1

| **Treatments** | **0t/ha** | | | | **5t/ha** | | | | **10t/ha** | | | | **15t/ha** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SR | | H/ | | SR | | H/ | | SR | | H/ | | SR | | H/ | |
| | E | L | E | L | E | L | E | L | E | L | E | L | E | L | E | L |
| WY | 13 | 17 | 2.46 | 2.57 | 13 | 17 | 2.46 | 2.64 | 13 | 17 | 2.49 | 2.68 | 13 | 17 | 2.44 | 2.64 |
| 3WAS | 13 | 16 | 2.36 | 2.47 | 13 | 16 | 2.36 | 2.49 | 13 | 16 | 2.41 | 2.54 | 13 | 16 | 2.42 | 2.52 |
| 3 & 6 WAS | 13 | 16 | 2.36 | 2.43 | 13 | 17 | 2.39 | 2.61 | 13 | 16 | 2.42 | 2.62 | 13 | 17 | 2.43 | 2.60 |
| 3, 5 & 7 WAS | 12 | 12 | 2.35 | 2.31 | 12 | 12 | 2.34 | 2.36 | 12 | 13 | 2.35 | 2.28 | 12 | 12 | 2.36 | 2.38 |
| 3, 6 & 9 WAS | 13 | 16 | 2.46 | 2.53 | 11 | 17 | 2.31 | 2.49 | 11 | 16 | 2.31 | 2.56 | 12 | 16 | 2.33 | 2.53 |
| SD | 0.45 | 1.95 | 0.06 | 0.10 | 0.89 | 2.17 | 0.06 | 0.11 | 0.89 | 1.52 | 0.07 | 0.15 | 0.55 | 2.07 | 0.05 | 0.10 |

SR= Specie Richness, H/ = Weed Specie diversity Index, E= Early Season, L= Late Season, WY= Weed Check, 3 WAS =Weeding at 3 Weeks after planting, 3 & 6 WAS = Weeding at 3 and 6 Weeks after plating, 3, 5 & 7 WAS = Weeding at 3, 5 and 7 Weeks after planting, 3, 6 & 9 WAS = Weeding at 3, 6 and 9 Weeks after planting, SD = Standard Deviation

**Table 9: Effects of poultry manure rates and weeding regimes on broadleaves, grasses, sedges and total weed dry weight in okra for the early and late wet seasons of 2012**

| | Broad leaves (kg/ha) | | Grasses (kg/ha) | | Sedges (kg/ha) | | Total Weed weight (kg/ha) | |
|---|---|---|---|---|---|---|---|---|
| **PM** | Early | Late | Early | Late | Early | Late | Early | Late |
| 0 t $ha^{-1}$ | 2132.96c | 1314.53 | 2568.4 | 1721.04 | 81.2 | 69.04 | 4782.56 | 3104.60 |
| 5 t $ha^{-1}$ | 2388.58b | 1311.86 | 2580.14 | 1717.53 | 72.44 | 48.12 | 5041.16 | 3077.52 |
| 10 t $ha^{-1}$ | 2601.78ab | 1372.15 | 2288.22 | 1685.06 | 77.24 | 58.36 | 4967.24 | 3115.57 |
| 15 t $ha^{-1}$ | 2682.51a | 1377.00 | 2396.3 | 1716.92 | 77.81 | 52.25 | 5156.61 | 3146.17 |
| SE± | 92.441 | 39.23 | 211.618 | 79.90 | 20.213 | 12.43 | 221.592 | 77.94 |
| **WR** | | | | | | | | |
| Weedy check | 5147.88a | 3209.26 a | 6989.72a | 4400.49 a | 218.24a | 158.80 a | 12355.84a | 7768.55a |
| 3WAS | 2615.51b | 1844.28 b | 3084.68b | 2392.91 b | 117.30b | 83.26 b | 5817.48b | 4320.44b |
| 3&6WAS | 1647.25c | 959.95 c | 1111.17c | 908.83 c | 31.18c | 24.41 c | 2789.60c | 1893.19c |
| 3,5&7WAS | 1466.93c | 464.22 d | 594.25d | 469.24 d | 10.51c | 10.41 c | 2071.69d | 943.87d |
| 3,6&9WAS | 1379.73c | 241.72 e | 511.50d | 379.21 d | 8.62c | 7.84 c | 1899.84d | 628.77e |
| SE± | 184.704 | 43.86 | 207.542 | 89.33 | 29.703 | 13.90 | 323.889 | 87.14 |
| PM × WR | NS | NS | NS | NS | NS | NS | NS | * |

Means followed by the same letter(s) within treatment group in the same column are not significantly different at 5% level of significance using Duncan's Multiple Range Test (DMRT).
PM- poultry manure, WR- weeding regimes, WAS- weeks after sowing, NS- not significant.

**Table 10: Correlations among growth, yield and yield components of okra in early wet season of 2012**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | - | | | | | | | | | | | | | | | |
| 2 | -0.58** | | | | | | | | | | | | | | | |
| 3 | -0.04 | 0.23 | | | | | | | | | | | | | | |
| 4 | 0.82** | -0.65** | -0.02 | | | | | | | | | | | | | |
| 5 | -0.96** | 0.52** | 0.08 | -0.78** | | | | | | | | | | | | |
| 6 | -0.80** | 0.43** | 0.19 | -0.59** | 0.83** | | | | | | | | | | | |
| 7 | -0.76** | 0.80** | 0.17 | -0.72** | 0.71** | 0.61*** | | | | | | | | | | |
| 8 | 0.94** | -0.56** | -0.17 | 0.76** | -0.96** | -0.81** | -0.73** | | | | | | | | | |
| 9 | 0.94** | -0.56** | -0.12 | 0.78** | -0.95** | -0.84** | -0.74** | 0.95** | | | | | | | | |
| 10 | -0.96** | 0.52** | 0.08 | -0.78** | 1.00** | 0.83** | 0.71** | -0.96** | -0.95** | | | | | | | |
| 11 | -0.65** | 0.78** | 0.20 | -0.64** | 0.59** | 0.55** | 0.93** | -0.63** | -0.65** | 0.59** | | | | | | |
| 12 | -0.87** | 0.76** | 0.19 | -0.79** | 0.84** | 0.71** | 0.87** | -0.83** | -0.86** | 0.84** | 0.82** | | | | | |
| 13 | -0.88** | 0.80** | 0.21 | -0.81** | 0.84** | 0.71** | 0.90** | -0.85** | -0.84** | 0.84** | 0.79** | 0.88** | | | | |
| 14 | -0.90** | 0.76** | 0.14 | -0.81** | 0.86** | 0.74** | 0.90** | -0.86** | -0.87** | 0.86** | 0.81** | 0.90** | 0.94** | | | |
| 15 | -0.93** | 0.65** | 0.15 | -0.83** | 0.91** | 0.78** | 0.80** | -0.94** | -0.91** | 0.91** | 0.70** | 0.86** | 0.88** | 0.90** | | |
| 16 | -0.82** | 0.78** | 0.16 | -0.74** | 0.78** | 0.69** | 0.93** | -0.81** | -0.81** | 0.78** | 0.85** | 0.83** | 0.92** | 0.91** | 0.84** | - |

NOTE: 1. Days to 90 percent flowering. 2. 100 seeds weight. 3. days to 1st flowering. 4. Days to 50 % flowering. 5. % survival. 6. Chlorophyll content at 10 WAS. 7. Shoot dry weight at 10 WAS. 8. Total dry weed weight. 9. Weed cover score at 9 WAS. 10. Stand count at harvest. 11. Plant height at 10 WAS. 12. Number of leaves at 10 WAS. 13. Fruit length. 14. Fruit girth. 15. Fruit count. 16. Fruit yield

**Table 11: Correlations among growth, yield and yield components of okra in late wet season of 2012**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | - | | | | | | | | | | | | | | | |
| 2 | -0.76** | | | | | | | | | | | | | | | |
| 3 | 0.90** | -0.70** | | | | | | | | | | | | | | |
| 4 | -0.91** | 0.81** | -0.86** | | | | | | | | | | | | | |
| 5 | -0.85** | 0.69** | -0.75** | 0.86** | | | | | | | | | | | | |
| 6 | -0.80** | 0.76** | -0.79** | 0.78** | 0.72** | | | | | | | | | | | |
| 7 | -0.90** | 0.82** | -0.85** | 0.93** | 0.82** | 0.89** | | | | | | | | | | |
| 8 | 0.93** | -0.81** | 0.84** | -0.92** | -0.86** | -0.80** | -0.88** | | | | | | | | | |
| 9 | 0.93** | -0.80** | 0.85** | -0.93** | -0.88** | -0.80** | -0.91** | 0.96* | | | | | | | | |
| 10 | -0.91** | 0.81** | -0.86** | 1.00** | 0.86** | 0.78** | 0.93** | -0.92** | -0.93** | | | | | | | |
| 11 | -0.85** | 0.78** | -0.80** | 0.86** | 0.79** | 0.88** | 0.88** | -0.90** | -0.87** | 0.86** | | | | | | |
| 12 | -0.65** | 0.62** | -0.59** | 0.66** | 0.59** | 0.68** | 0.68** | -0.66** | -0.65** | 0.66** | 0.68** | | | | | |
| 13 | -0.89** | 0.84** | -0.85** | 0.88** | 0.80** | 0.88** | 0.91** | -0.89** | -0.88** | 0.88** | 0.89** | 0.68** | | | | |
| 14 | -0.89** | 0.84** | -0.84** | 0.90** | 0.84** | 0.91** | 0.94** | -0.93** | -0.91** | 0.90** | 0.94** | 0.70** | 0.93** | | | |
| 15 | -0.79** | 0.75** | -0.71** | 0.84** | 0.76** | 0.78** | 0.84** | -0.81** | -0.83** | 0.84** | 0.82** | 0.64** | 0.81** | 0.84** | | |
| 16 | -0.86** | 0.80** | -0.79** | 0.84** | 0.79** | 0.90** | 0.89** | -0.90** | -0.86** | 0.84** | 0.97** | 0.69** | 0.91** | 0.94** | 0.82** | - |

NOTE: 1. Days to 90 percent flowering. 2. 100 seeds weight. 3. 1st day to flowering. 4. Days to 50 % flowering. 5. % survival. 6. Chlorophyll content at 10 WAS. 7. Shoot dry weight at 10 WAS. 8. Total dry weed. 9. Weed cover score at 9 WAS. 10. Stand count at harvest. 11. Plant height at 10 WAS. 12. Number of leaves at 10 WAS. 13. Fruit length. 14. Fruit girth. 15. Fruit count. 16. Fruit yield

8/23/2015