CHAPTER VIII

SUMMARY

INTRODUCTION

The Present study has been carried out in the agriculture farm of R.H.S.P.G. College, Singramau.(25° 57' N latitude and 82° 24' 20" E longitude) situated along the N.H.56 at Singramau, Jaunpur. Two cropfields have been selected on the agriculture farm in the respective rainy and winter seasons distinguished as ‘kharif’ and ‘rabi’ cropfields of one hectare area each, which was further divided in to three fields of 35x 100m size each on the basis of different weeding treatments. These plots have been recognized as unweeded, partially weeded and fully weeded or weedfree cropfields. An ecological study in relation to edaphic characteristics, phytosociology, biomass, rate of primary production and energetics has been done on these cropfields under influence of weed infestation. The invasion of weeds hamper the healthy growth of crop plants and cause drastic reduction in crop yield. The findings regarding the study are pointed out as follows:

Enumeration:

- Two crops of economic significance were maize (Zea mays L.) and linseed (Linum usitatissimum L.) were, selected as experimental crops for kharif and rabi cropfields, respectively on which impacts of infesting seasonal weeds have been studied with respect to various aspects.

- Each cropfield was divided in to three distinct fields of 35X100 m size each. The first field was allowed for growing seasonal weeds frequently in cropping seasons, the second field was treated with partial removal of weed species from cropfields and third field was kept free from weeds by complete removal of weed species
though manual weeding in respective cropping seasons and made free from weeds which was, identified as ‘weedfree’ or ‘weeded’ field.

- Among all the three field s of each cropfield, first field was distinguished as ‘unweeded’, the second as ‘partially weeded’ and third one as ‘weeded ‘or ‘weedfree’ field on the basis of varying weeding treatments.

- The year is divisible in to three main seasons viz. rainy (July to October), winter (November to February) and summer season (March to June ).

- The climate is typically monsoon. Total rainfall during sampling period (from July, 2004 to March,2005) was 482.3 mm, out of which 354.80 mm was recorded during the rainy season .The mean maximum temperature was highest 33.9°C in September whereas the mean minimum temperature was 10.4°C in January month of winter season.

- Field observations and sampling were done periodically through out the study period from July-2004 to March-2005. Phytosociological observations were done at monthly intervals whereas sampling of soil and plant parts were done at monthly basis for former and at fortnightly for latter one.

- Samples were always collected in triplicates for soil and plant parts in order to analyze different related parameters.

- The soil of the experimental cropfields is sandy loam containing large proportion of silt and clay which may be grouped under transported basaltic type of alluvium.

- Soil moisture varied considerably in different depths and fields in different months of the year which was always higher in the
unweeded field as compared to partially weeded and weedfree field s where it was found to be lowest in weedfree field.

- Soil porosity was fairly high. The surface soil appears to be more compact up to 10cm for both cropfields. The soil porosity varied distinctly from 42.62% to 56.15% for kharif and 42.56% to 61.53% for rabi cropfield separately.

- The water holding capacity was found to be ranged from 34.58 to 43.74% for kharif cropfield whereas 35.38 to 45.68% for rabi cropfield which demonstrates that both of the cropfields have almost similar water retaining capacity.

- The soil pH varied narrowly on alkaline side (from 7.3 to 8.7) for both the cropfields. The pH was distinctly higher during the rainy and in early winter seasons.

- The organic carbon content decreased down the depths in all the three fields and all the months at both the cropfields. Its value varied from (1.376 to 5.378 mg g⁻¹) at kharif cropfield and from (1.548 to 6.237 mg g⁻¹) at rabi cropfield which was observed to its maximum in the month of November.

- The Organic matter (from 3.16 to 9.27 mg g⁻¹) at kharif cropfield and (from 2.67 to 10.75 mg g⁻¹) at rabi cropfield was also high in November.

- The total soil nitrogen (from 0.216 to 0.450 mg g⁻¹) at kharif cropfield was always high in the months onwards to July whereas (from 0.165 to 0.468 mg g⁻¹) at rabi cropfield in winter season.

- The C: N ratio varied from 6.485 to 11.951 at kharif cropfield and from 7.129 to 13.069 at rabi cropfield. The ratio was extremely high in the month of November at rabi cropfield and comparatively lower at the kharif cropfield.
The available phosphorus of soil varied from 16.50 to 71.65 µg g⁻¹ g at *kharif* cropfield and from 8.65 to 64.15 µg g⁻¹ maximum in the month of October for all the three fields at *kharif* cropfields and in the month of November for all the three fields at *rabi* cropfield.

Phytosociological studies reveal that total number of weed species was 30 found at the *kharif* cropfield in the month of September while the maximum number of weed species was 40 recorded at the *rabi* cropfield in the month of January, out of which 20 weed species were found common in both the study cropfields.

The therophytes were obtained greater in number in comparison to the other life-forms.

Phytosociological parameters such as frequency, density, abundance, basal cover, relative frequency, relative density, relative dominance and ultimately the importance value Index (IVI) were studied at monthly interval for both the cropfields.

The percentage distribution of plant species in well distinguished five frequency classes shows high degree of heterogeneity among the species occurred at present study cropfields.

‘Dominant’ and ‘co-dominant’ plant species were identified among the plant species occurred at both the cropfields on the basis of IVI. *Cynodon dactylon* (Linn.) Pers. and *Cyperus rotundus* Linn. were found to be distinguished as 'dominant' and 'co-dominant' weeds at both the cropfields, respectively. The remaining weed species were put together as 'rest weeds'.

Maximum density of weeds was recorded in the month of September at *kharif* cropfield and in the month of January at *rabi* cropfield.
cropfield which were found 109.30 m$^{-2}$ and 109.51 m$^{-2}$, respectively. The density of maize crop was found to be maximum of 4.38 m$^{-2}$ in the month of October whereas of linseed was 21.36 m$^{-2}$ to be maximum in the month of February during entire cropping season.

- The maximum value of basal cover of weeds was obtained 9.25 cm$^2$ m$^{-2}$ in the month of October and .5961 cm$^2$ m$^{-2}$ in the month of February at respective *kharif* and *rabi* cropfields while basal cover value was 8.367 cm$^2$ m$^{-2}$ and .502 cm$^2$ m$^{-2}$ found to be maximum for maize and linseed crops at their respective cropfields in the month of October and March, respectively.

- On the basis of IVI *Cynodon dactylon* (Linn.) Pers. was identified as most ‘dominant’ weed and *Cyperus rotundus* Linn. as ‘co-dominant’ weed at both the cropfields having attained its maximum value 37.16 (*rabi*) and 33.61 (*kharif*) in the months of November and July for ‘dominant’ weed whereas the maximum IVI values were 33.62 (*rabi*) and 31.91 (*kharif*) in the months of November and July for ‘co-dominant’ weed at their corpfields, respectively.

- The most common weeds at *kharif* cropfield were *Anagallis arvensis* L., *Echinocloa crus-galli* (L.) Beauv., *Commelina benghalensis* L., *Panicum frumentacea* L., *Phyllanthus fraternus* Webster, *Alternanthera sessilis* (L.) R. Br. ex.DC., *Desmodium triflorum* (L.) DC., *Blumea laciniata* (Roxb.) DC., *Ammania baccifera* (L.), *Aneilema nudiflorum* R. Br., *Scoparia dulcis* L., *Corchorus aestuans* L. and *Caesalia axillaris* Roxb. etc. and at *rabi* cropfield they were *Phalaris minor* Retz., *Avena fatua* L.,

The standing crop biomass increment has been estimated separately for plant parts such as stem, leaf, fruits and root in case of maize and linseed crops, selected as experimental crops. The peak value of leaf biomass of maize was obtained to be 214.52 g m\(^{-2}\) at the age of 90 days and up to this age it showed continuous increase but stem biomass superseded the leaf biomass at the same age, attained to its maximum value of 551.36 g m\(^{-2}\) at the age of crop maturity in unweeded kharif cropfield. The maximum value of biomass of maize followed the increasing trend up to the age of crop maturation and maximum value was recorded 48.65 g m\(^{-2}\) at unweeded kharif cropfield. The maize crop attained its total peak biomass of 1078.65 g m\(^{-2}\) and showed gradual increase in its value up to the age of crop maturation. The standing crop biomass of different components of maize crop as stem, leaf, fruit and root followed the same trend for partially weeded and weedfree
cropfields also. The peak total biomass values were 1219.49 g m\(^{-2}\) and 1451.34 g m\(^{-2}\) estimated for maize crop at partially weeded and weadfree kharif cropfields, respectively.

The maximum value of leaf biomass of linseed crop was 56.38 g m\(^{-2}\) at the age of 90 days whereas stem biomass was found to its maximum of 164.85 g m\(^{-2}\) at 120 days of crop age. The leaf biomass showed increasing trend upto the age of 90 days, after then decreasing trend was shown by it till the crop maturity. The biomass value of stem superseded the leaf biomass after 45 days of crop age and showed continuous increase in biomass up to the age of crop maturation. The fruit biomass began rising from the age of initiation and reached the maximum of 285.92 g m\(^{-2}\) when the crop entered in senescent stage. The biomass of root followed the increasing trend up to 105 days and it reached the maximum biomass value of 28.45 g m\(^{-2}\) after then its value was found to be decreased. The peak value of total biomass of linseed crop was recorded to its maximum of 487.58 g m\(^{-2}\) at the age of crop maturity at weed free plot. The fractionated biomass of vegetative parts of linseed crop showed the similar trend for unweeded and partially weeded, rabi cropfields as shown by the crop plant at weed free cropfield. The maximum value of total biomass of linseed plant was 345.25 g m\(^{-2}\) and 429.30 g m\(^{-2}\) estimated at unweeded and partially weeded rabi cropfields, respectively.

The standing crop biomass of aboveground parts of ‘dominant’ weed, Cynodon dactylon (L.) Pers. and 'rest weeds' showed increasing trend till the age of crop maturation at unweeded, partially weeded and weedfree kharif and rabi cropfields. The biomass of underground part of ‘dominant’ and 'rest weeds'
showed continuous increase up to the age of 90 days later on its value was found to be decreased at both the cropfields in three different field conditions. The peak values of biomass for aboveground parts of ‘dominant’ weed, *Cynodon dactylon* and 'rest weeds' were recorded 112.85 g m$^{-2}$ and 127.23 g m$^{-2}$ at 105 days in *kharif* cropfield whereas its values were found maximum of 102.85 g m$^{-2}$ and 87.65 g m$^{-2}$ at the age of 120 days for *Cynodon dactylon* and 'rest weeds', respectively at *rabi* cropfield. The biomass values of underground parts of ‘dominant’ and 'rest weeds' were recorded to be maximum of 61.43 g m$^{-2}$ and 47.58 g m$^{-2}$ at *kharif* and 63.27 g m$^{-2}$ and 58.06 g m$^{-2}$ at *rabi* cropfield at the 105 days of age, respectively.

The percentage contribution of biomass of stem and of fruit from the age of initiation showed increasing trend till the age of crop maturity whereas biomass contribution of leaf and root showed decreasing trend upto the age of crop maturation for both the crops in all the three different conditions of their respective cropfields. The peak value of percentage biomass contribution of stem was 51.12% at 105 days, of leaf 54.26% at 15 days, 27.76% for fruit at 105 days and 17.52% for root at 15 days of crop age of maize crop at *kharif* cropfield. Similarly peak values of biomass percentage contribution was 54.35% at 75 days, 71.98% at 15 days, 36.62% at 105 days and 24.58% at 60 days of crop age for stem, leaf, fruit and root of linseed crop in field, respectively.

The total biomass of community (crop and weeds) for both the cropfields (*kharif* and *rabi* cropfields) continuously increased up to the age of crop maturity with the maximum values 1373.08, 1474.31 and 1411.93 g m$^{-2}$ in the unweeded, partially weeded and
weedfree *kharif* cropfields at 105 days of crop age whereas for *rabi* cropfield the peak values were 763.85, 705.62 and 487.58 g m$^{-2}$ recorded at 120 days of crop age in unweeded, partially weeded and weedfree cropfields, respectively.

- The net primary productivity has been determined by deducting the separate biomass values of the preceding month from the current month during the study period. It has been expressed in g m$^{-2}$ day$^{-1}$.

- The maximum rate of dry matter production of weeds in an unweeded cropfield of maize was 7.17 at the age of 90 days and in linseed cropfield was 5.72 at 90 days of crop age when the crop plants were in flowering stage. After that the rate decreased to -2.48 and -2.75 g m$^{-2}$ day$^{-1}$ in the respective *kharif* and *rabi* fields partly due to the disappearance of some of the weeds as well as litter-fall and partly due to senescence.

- Comparing the rate of production of unweeded cropfield with that of fully weeded or weedfree cropfield for both the crops it was observed that the rate of production in weed free cropfield is very high and it is maximum for maize crop was found to be 33.92 and for linseed 10.09 g m$^{-2}$ day$^{-1}$ at the of 90 & 105 days, respectively. This is considerably higher than the combined productivity of maize and linseed crop and weeds separately in unweeded field condition. In partially weeded condition of cropfields, the rate of production of maize and linseed was higher than in unweeded cropfields but lower than fully weeded or weedfree cropfields.

- There was sharp increase in the rate of production of fruits in fully weeded or weedfree cropfields of maize and linseed crops. The
maximum rate of fruit production of maize crop was estimated 7.63, 9.40 and 11.39 g m⁻² day⁻¹ and of linseed crop was 9.50, 10.30 and 10.68 at unweeded, partially weeded and fully weeded or weed free cropfields, respectively.

- The peak net primary productivity of the total plant community during the crop period at maize crop field was 33.32, 38.49 and 33.92 at 90 days and at linseed cropfield was 9.11, 14.50 and 10.09 in unweeded, partially weeded and weed free field conditions at respective crop age of 90 days for former and 105 days for last two cropfields, respectively.

- The peak grain yield of maize was 1.85 tonn ha⁻¹ (unweeded), 2.16 tonn ha⁻¹ (partially weeded) and 2.53 tonn ha⁻¹ (weedfree) cropfields whereas the maximum grain yield of linseed was 1.02 tonn ha⁻¹ (unweeded), 1.35 tonn ha⁻¹ (partially weeded) and 1.64 tonn ha⁻¹ (weedfree) cropfields per cropping season.

- The peak value of calorific concentration in leaf of maize crop was 4623.52 cal g⁻¹ at 60 days, stem 4328.63 cal g⁻¹ at 90 days, seeds 5384.63 cal g⁻¹ at 105 days and root 3582.94 cal g⁻¹ at 90 days at weedfree cropfield except the second value at unweeded kharif cropfield.

- The peak calorific concentration recorded in abovegrounds and underground parts of ‘dominant’ weed, *Cynodon dactylon* and 'rest weeds' were 4082.36 cal g⁻¹ and 3784.52 cal g⁻¹ and 4065.26 cal g⁻¹ and 3852.37 cal g⁻¹ at the age of 90 days in partially weeded kharif cropfield, respectively.
The peak calorific concentration in linseed leaf was 4658.43 cal g\(^{-1}\) at 60 days, stem 3874.86 cal g\(^{-1}\) at 105 days, seeds 6052.18 cal g\(^{-1}\) at 120 days and root 4256.78 cal g\(^{-1}\) at 105 days of crop age at weedfree cropfield. The rest two cropfields showed comparatively lower concentration values in relation to linseed crop plant in its component parts.

The maximum calorific concentration in aboveground and underground parts of ‘dominant’ weed, *Cynodon dactylon* and ‘rest weeds’ was found 4082.36 cal g\(^{-1}\) and 3784.52 cal g\(^{-1}\) and 4065.26 cal g\(^{-1}\) and 3852.37 cal g\(^{-1}\) at the age of 90 days in partially weeded *kharif* cropfield whereas peak calorific concentration of respective weeds in their respective aboveground and underground parts recorded were 4065.37 cal g\(^{-1}\) and 3754.78 cal g\(^{-1}\) and 4098.36 cal g\(^{-1}\) and 3824.75 cal g\(^{-1}\) at 105 days age in partially weeded *rabi* cropfield.

The maximum energy accumulation in maize leaf was found 1074.01 kcal m\(^{-2}\) at 90 days, in stem 2627.86 kcal m\(^{-2}\) at 105 days, in seeds 1364.79 kcal m\(^{-2}\) at 105 days and in root 274.38 kcal m\(^{-2}\) at 90 days in fully weeded cropfield whereas in linseed leaf it was found 247.32 kcal m\(^{-2}\) at 90 days, stem 595.33 kcal m\(^{-2}\) at 105 days, seeds 994.07 kcal m\(^{-2}\) at 120 days and roots 121.11 kcal m\(^{-2}\) at 105 days in weedfree *rabi* cropfield.

The variation in standing state of energy in the aboveground and underground parts of ‘dominant’ and ‘rest weeds’ followed the same trend in both unweeded and partially weeded *kharif* cropfields. The maximum value of standing state of energy in the aboveground parts was 481.27 kcal m\(^{-2}\) for ‘dominant’ and 366.23
kcal m\(^{-2}\) for ‘rest weeds’ whereas its peak values for underground parts were estimated 224.48 and 179.18 kcal m\(^{-2}\) for ‘dominant’ and ‘rest weeds’ at 90 days of plant age in unweeded cropfield, respectively.

- The peak value of standing state of energy in the aboveground parts was 489.90 and 372.99 kcal m\(^{-2}\) recorded for ‘dominant’ and ‘rest weeds’ while its value for underground parts was found to be maximum of 231.09 and 211.52 kcal m\(^{-2}\) for ‘dominant’ and ‘rest weeds’ at the age of 105 days in unweeded \textit{rabi} cropfield, respectively.

- The maximum total energy storage of ‘dominant’ weed, \textit{Cynodon dactylon} and ‘rest weeds’ was 705.75 and 545.41 kcal m\(^{-2}\) at 90 days of plant age in unweeded \textit{kharif} cropfield, respectively whereas values of 720.99 and 584.52 kcal m\(^{-2}\) were found to be maximum for respective ‘dominant’ and ‘rest weeds’ at the age of 105 days in unweeded \textit{rabi} cropfield.