SUMMARY &CONCLUSIONS

CHAPTER VI

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Part A Tobacco waste management as organic manure:

A field experiment was conducted to study the effect of tobacco waste (stalk) compost as a sole and in conjunction with inorganic fertilisers and other organic manures on chickpea under conserved soil moisture in vertisols. The organic sources included were farm yard manure, filter press cake, tobacco stem compost and soybean trash compost. After carrying out two year field evaluation, the effect of sole organic and inorganic fertilisers and in combination of both and also by adding zinc sulphate as one of the treatments, the following conclusions are drawn.

Organic manures are superior to improve both soil characteristics (physical, chemical and biological) and productivity of chickpea crop. Among the organic manures, the tobacco stems compost @ 2.5 t / ha was superior as sole organic manure compared to others. It is in combination with 100% RDF+ $ZnSO_4$ is superior to all other combinations of organic manures with fertiliser schedules. Tobacco stem compost application significantly improved the soil organic carbon, available nitrogen and phosphorus, reducing soil pH from saline toward neutral range and the percent increase in the soil moisture. The percentage improved soil moisture by TSC encouraged the uptake of soil available and applied nutrients efficiently and resulted on chickpea crop yield attributes and grain yield.

In case of soil characteristics, the percent organic carbon increase by second year due to TSC application is 0.51 followed by FYM 0.50, FPC 0.49, STC 0.46 and 0.41 in control as against the initial 0.41 % in all the treatments. Available nitrogen by TSC 174.50kg / ha followed by FYM 169.30 kg / ha, FPC 167.70 kg /ha STC 157.85 kg .ha and in control it was 140.55 kg /ha as against the initial 150 kg / ha. Available phosphorus in TSC is 40.94 kg / ha followed by FPC 40.53 kg / ha, FYM 39.76 kg /ha, STC 37.43 kg / ha and in control it was 31.79 kg /ha as against the initial levels of 37.05, 37.03, 35.82, 37.50 and 38.50 respectively.

Soil chlorides were also influenced by application of organic manures. The lowest level of chlorides was recorded by application of TSC application followed by FYM, FPC, and STC indicating the reduction of soil salinity. The soil moisture in TSC applied plots was 17.04 % followed by FYM 16.13%, STC 15.76%, FPC 15.10 % against the control 15.10%.

In case of nutrient use efficiencies, TSC applied plots recorded maximum use efficiencies of the applied nutrients followed by FYM, FPC and STC both in agronomical and physiologically. The grain yield of chickpea was significantly high in TSC applied plots with 2.64 t /ha followed by FYM 2.18 t /ha, FPC 2.08 t / ha , STC 1.93 t / ha as against the control 1.90 t / ha.

From this experiment on chickpea, it is concluded that application of organic manures @ 2.5 t / ha such as TSC, FYM and FPC with 100% RDF NP + 15 kg $ZnSO_4$ were more effective and economical sources for obtaining higher chickpea yield and also to maintain the soil health for sustainable crop production. The benefit ratio with TSC + 100% RDF + 15 kg ZnSO4 was 3.49 and an extra income of Rs. 20,075 could be gained by the farmer.

Part B Tobacco leaf waste management as biopesticide:

A field experiment was conducted to study the efficacy of bio pesticides against lepidopterous pest (*S.litura* and *H.armigera*) on chickpea. The bio-insecticides included are viral and botanical pesticides. After carrying out two year field. Evaluations on the efficacy of bio pesticides, the following conclusions were drawn.

Bio pesticides were superior in checking the pest infestation on chickpea both S.litura and *H.armigera*. Among them, botanical extraction products *viz, Andrographis paniculata* (Kalmegh) 2% Tobacco midrib (e) 2% and NSKS 2% were superior because of their repellent and anti feedant properties. These three botanical pesticides were on par with chemical pesticide chlorpyriphos and followed by NPV and PSKS.

In case of larval count and percentage of crop damage, Kalmegh (2%), Tobacco mid rib power Extraction (2%) and NSKS (2%) were superior followed by NPV 250 LE and PSKS (2%) which were at par with chemical insecticide chlorpyriphos (0.2%). Other treatments also exhibited more than 50% less larval count and percentage of damage compared to control.

In case of oil formulations, Neem oil and Pongamia seed oil while controlling the insect pest but showed toxic affect on chickpea crop by yellowing the foliage and advancing the crop maturity with fewer yields compared with other botanicals. However, they showed beneficial effects giving more grain yield by 38% neem oil and 34% pongamia oil over the absolute control. Though, oil formulations showed toxic symptoms on foliage, could control the larvae and hence, the grain yield was more compared to absolute control.

Natural enemy population was more in bio pesticides applied plots and very less in chemical control plot. The predators recorded were coccinellids, spiders and reduevid bugs where as the parasites recorded were apanteles, peribeae and chelonous. NPV treated plot habitated more of natural enemies followed by tobacco mid rib extraction, Pongamia oil, Kalmegh and NSKS indicating oil formulation of Pongamia is toxic to foliage but not to natural enemy to casidoptera. Chickpea yields recorded in various treatments indicated that maximum grain yield of 2.398 t/ha was recorded by kalmegh with 84% higher yield over control followed by tobacco midrib extraction recording 2.303 t/ha by

77% higher, chlor,pyriphos recording 2.321 t/ha with 78% higher yield and NSKS with 2.158 t/ha with 65% higher . These four treatments were at par with each other in this regard. The higher yields were achieved because of low larval population and subsequently less crop damage.

Economics of bio pesticides application to chickpea:

The economics of these bio pesticides was worked out under two categories i.e., viral (Nuclear polymerases virus) and botanicals such as neem oil, neem seed kernel suspension (NSKS), pongamia oil, pongamia seed kernel suspension; kalmegh, tobacco waste leaf extraction (TWLE), tobacco midrib powder extraction(TMPE) and chemical insecticide chlorpyriphos.

Because of less cost, safer to parasites and predators, human beings, animals, water (fish), soil and environment, ttobacco mid rib powder of water extraction can also be recommended as botanical pesticide along with other botanical pesticides to the farming community as an alternative to chemical pesticides.

From the two year experiment on *Heliothis armigera* and *Spodoptera litura*, it is concluded that extracts of kalmegh 2%, Tobacco mid rib extract 2% and NSKS 2% are the more effective and economical, bio pesticides on the other hand are safe to natural enemies, human beings and also environment. Hence, these bio pesticides can be recommended to the farming community for inclusion in organic farming.

Conclusion:

From the above two parts, it is concluded and recommended that the tobacco waste which is available now a days in large quantities can successfully be used as an effective source of organic manure and insecticide for improvement of crop yield.

This recommendation is an eco friendly, economically viable to adopt in organic farming as organically grown products are having lot of demand now a days. The organic food products has good shelf life, taste, nutritious and more safe as they are chemical residue free for human consumption. Organic farming maintains the soil health for sustainable crop production for successive generations.