6. SUMMARY AND CONCLUSIONS

Poplar with high productivity in 6-12 years rotation is being preferred, particularly boundary plantation, for various agroforestry systems in different part of India. Wheat is one of the most important rabi associated/inter-crop being grown with its association. In addition to supplement farm income, poplar provides organic matter and improves the physico-chemical properties of the soil. Competition/synergies of this binary system of production is subject to many above ground and below ground interactions. Therefore, a quantitative approach is an important step in the quest for better understanding of the complex mechanisms of tree-crop interaction, which should offer scientific basis for designing productive and sustainable agroforestry systems.

The study was conducted during 1994-95 and 1995-96 at the experimental farm, Department of Agronomy, Janta Vedic College, Baraut, Bagpat, Uttar Pradesh. Baraut is situated at a height of 230m above mean sea level, intersected by 29°6’N latitude and 77°60’E longitude. The soil of the experimental field varied in texture from sandy clay loam to loam and was low in nitrogen and phosphorus with pH varying from 6.5 to 7.1. To conduct the study, wheat (*Triticum aestivum*), variety HD-2285 was sown in an agricultural field having a single row boundary plantation of three year old poplar (*Populus deltoides*, clone ‘G-3’) trees, already existing (3.5m tree to tree distance) and oriented in north-east and south-west direction. To fulfil the objectives, field study was supplemented with the pot as well as laboratory experiments.

Present investigation reveals that age of the poplar trees was one of the most important factors influencing growth and yield parameters of wheat. The magnitude of adverse effect was increased as the sphere of influence was extended with advancement in tree age. Adverse effect of boundary plantation of poplar on the wheat crop was significant only under the crown (upto 3m from the base), a zone of relatively high competition for nutrient as well as soil moisture and allelopathic interactions. Wheat grain yield declined significantly (15.5%) upto a distance of 3m due to 4 year old plantation only. Among
growth parameters, plant population of wheat suffered heavily up to a distance of 9m in both the years; however, relative proportion of effective tillers, dry matter production, 1000 grain weight, straw yield and leaf area index increased significantly between 3-9m distance from tree line, depending upon the age of plantation. Nutrient and moisture was depleted considerably near the tree line (0-6m) up to 75 cm soil depth which caused moisture stress as well as nutrient deficiency to the wheat crop. At the same time, boundary plantation of poplar had favourable effect on the micro-climate which improved the status of soil moisture between 0-9m distance. Competition for natural resources was reduced between weeds and wheat due to reduction in weed population and biomass in the system. Considerable quantity (upto 1292 kg ha\(^{-1}\)) of poplar leaf litter up to a distance of 9m was added into the soil, caused synergetic effect and had tendency to improve the physico-chemical environment of the soil. Though the net returns from associated wheat crop was low as compared to sole crop, but loss was compensated by additional returns from poplar trees. Lower k values (1.14 to 1.21) near the tree line indicated slow rate of decomposition under the vicinity of trees. In an intensively managed poplar-wheat based agroforestry system, 69 to 83 per cent mass of poplar leaf litter was lost after one year during the process of decomposition. Results of pot experiment revealed that better growth and higher grain yield can be obtained by incorporating the poplar leaf in combination with chemical fertilisers and it increased with increasing doses of poplar leaf. In presence of poplar leaf litter, temporary nutrient deficient environment was created during active vegetative stage of crop which can be overcome by combining chemical fertiliser with leaf litter at the time of its incorporation. Findings of laboratory studies revealed that the aqueous leachates of partially decomposed poplar leaves have retardatory effect on the germination and growth of wheat as well as *Phalaris minor*. Toxic effect of aqueous leachates of soil underneath poplar tree vindicated the accumulation of allelochemicals in the soil which was a function of amount of leaf litter added into the soil. Magnitude of reduction was more (almost double) in *Phalaris minor* than wheat.