2. REVIEW OF LITERATURE

The participation of the individuals in the social activities of society links them with other members of the society and exposes them to a variety of ideas and improved practices, as their interaction increases. The individual with a higher level of social participation tends to be both innovative and venturesome and deliberately seeks out most dependable sources for accurate information about relevant innovations.

Entrepreneurial characteristics are very important for becoming a successful entrepreneur of orchard management. These characteristics viz., risk taking, motivation for achievement and adoption of improved techniques, motivation independence, problem solving, decision making into innovativeness etc. may be inborn or can be developed in an individual. Venkatapaty (1980) found that the first generation entrepreneurs were more enterprising, more social, less conventional more willing to adopt innovations, practice and had a more positive self respect than second generation entrepreneurs who were more interested in managing an existing orchard.

Sethy et al. (1984) studies the entrepreneurial characteristics of farmers in Cuttak district of Orissa and found that social participation besides other variables influenced the three groups of farmers viz., small, marginal and big differently. They reported that social participation in case of big farmers was occupying offices like
village Pradhan, member of the Gram Panchayat and Secretary of the Service Cooperative Society due to which they used to come in close contact with extension personnel that might have helped them in getting better services from them for adoption of improved practices.

Bhaskaran and Thampi (1986) reported that there is no relationship between progressiveness and extent of adoption of improved agricultural practices. Regarding the respondents socio-economic characteristics, none was found to be related with their extent of adoption which may be due to their progressiveness. They also reported that there was no significant correlation between farmers' level of social participation and their extent of adoption. No significant relationship was also reported between farmers' perception of cost of innovation and the extent of adoption. Age, extent of land holding, education and risk perception were also reported to be non significantly related with extent of adoption of improved agricultural practices.

Deolankar (1989) made an attempt to understand the background of entrepreneurs and their attitude towards the growth and modernization of their units. The motivation for starting industrial ventures for 37.12 per cent units was a desire to do something pioneering and innovative.

Bhagwan Singh (1997) reported the adoption gap in improved agricultural technology in Uttaranchal hills. Overall, the maximum adoption gap was 59% and 52% in the adopted village and 84% and
77% in the non-adopted village for rape and pea technology, respectively. The adoption gap in soybean and paddy was 49% and 44% in the adopted village and 72% and 71% in the non-adopted village respectively. The maximum adoption gap was found in plant protection measures (84%-96%) in all the crops in the non-adopted village while it was 56% to 88% in the adopted village. The study showed that the overall adoption gap was greater in the non-adopted village for all practices.

Gogi (1997) reported the adoption behaviour of pineapple growers in Kamrup district of Assam. The study shows that a high proportion of pineapple growers do not adopt recommended practices. Use of chemicals for flower induction and plant protection measures were found to be completely absent. The study also shows that knowledge, land holding, social participation, income and extension contact were the dominant dimensions in explaining the variability in adoption of different recommended practices of pineapple cultivation.

Iyer et al. (1997) reported the advances in classical breeding and genetics in mango. Although there have been difficulties in mango hybridization, new hybrid varieties have been successfully released from many centres. In many countries, large number of hybrids are under intense screening, and many hybrids cultivars are due to be released. However, the adoption rate of new cultivars is slow. The use of clonal selection in breeding programmes is
considered. It is suggested that introducing cultivars from one country to another and from one agroclimatic zone to another should be thoroughly researched to avoid disease problems. Screening of cultivars under different agroclimatic zones has shown that genotypes X environment interaction can vary significantly for the same characteristics.

**Mai Chand (1997)** reported the constraint analysis of tribal farmers of Himachal Pradesh in adoption of improved apple cultivation. Sixty farmers from 3 villages of the tribal district of Kinnaur, Himachal Pradesh, India, were surveyed in 1994 as to which of 34 items they perceived to be constrictions to the adoption of improved apple cultivation practices. The items of the constraint index were developed in consultation with researchers, extension personnel and progressive farmers and were grouped into 4 categories (inputs, production, marketing and technical guidance). Unavailability and high cost of inputs were both cited as constrictions to adoption of improved apple cultivation practices in 51.67% of cases. Other important input-related constraints were poor timeliness of arrival of inputs, poor quality of inputs, inadequate credit facility and complicated credit procedure. Uncertainty of weather, which caused early flowering and poor fruit setting, was the highest ranking production constraint (70%), followed by lack of irrigation facilities (56.67%), high labour costs (55%), small land holding (51.67%) and fruit drop (48.33%). The most important
marketing constraints were road blockades at the time of transportation (50%) and unavailability of markets (48.33%), while lack of guidance regarding selection of appropriate cultivars (48.33%), fertilizer application (43.33%) and utilization of culled fruits (43.33%) were the highest ranking technical constraints.

Oosthuysen (1997) reported the effect of long term controlled atmosphere storage on fruit quality in Heidi mango. Heidi mango fruit were harvested at the conventional stage and at an advanced stage of maturation from an orchard in South Africa. Following commercial pack line treatment, fruits were stored at 12.5°C either under controlled (modified) atmosphere (CA) storage (low or high concentrations of [CO₂]) or under normal atmosphere storage. After 21 days, fruits were allowed to ripen at 20°C under normal atmosphere. Quality was assessed on ripening. Fruits harvested at an advanced stage of maturation did not appear to benefit from CA storage. Pulp browning in these fruits was elevated. In fruits harvested at the conventional stage of maturation, CA storage reduced surface scald, pulp browning and internal breakdown, and enhanced shelf life and taste. The semi-commercial adoption of CA storage in Heidi mango is recommended for the coming season.

Parodi and Apaza (1997) reported the development and management of the mango (Mangifera indica L.) crop in Peruvian condition. Mangoes have contributed more than any other fruit crop to exports of horticultural products in Peru and in 1996 generated
$11 million FOB. The areas with greatest development of mangoes were Piura and Lambayeque, representing 64.3% of the total harvested area of mango in Peru.

Sharma (1998) reported Punjab farmers’ response on control of weeds and fruits dropping in mango orchard.

Responses from 200 farmers in three selected districts of the Indian Punjab State revealed that adoption of recommended technology for weed control in mango (Mangifera indica L.) orchards was very poor. The use of weeds as fodder, high cost of herbicides, lack of technical guidance and lack of time were identified as major constraints in the adoption of recommended practices for the control of weeds and fruits drop in mango orchards. It is suggested that concerted efforts are required on the part of extension scientists working at the grass roots level to promote awareness among mango growers of the advantages of weed control measures. Possible methods considered include, the organization of short-term maintenance of regular contracts with mango growers.

Islam et al. (1998) reported the relationship of Green Revolution Technology adoption of the farmers with their six related characteristics. Out of the six selected characteristics, only education and farm size of the respondents were positively correlated with the adoption behaviour of the respondents. While age of the respondents had a negative correlation with adoption behaviour. Family size, cosmopolitans and extension contact of the farmers had no
significant relationship with the adoption behaviour of the respondents.

Kashem and Mikuni (1998) reported the farm techniques used by the Japanese farmers in achieving sustainable agricultural development. The findings reveal that farmers’ use of farm techniques were the highest in rice cultivation followed by vegetables and flowers, and fruits respectively. The use of farm techniques by the farmers had significant positive correlation with their farm size and contact with information sources.

Kotur and Murthy (1998) reported the root activity distribution studies in citrus, grape, mango and guava using isotopic techniques. Soil injection of carrier-free 32 P was used to study root activity distribution in fruit crops. All 4 citrus crops (oranges, 2 types of mandarin, and limes) were shallow-rooted while grape (cultivars Anab-a-Shahi and Thompson Seedless), mango (cv. Aphonso) and guava (cv. Arka Mridula) were deep-rooted. The spread of active roots was uniform during north-east monsoon period due to uniformly moist soil mantle. During summer, the active roots moved toward the soil surface and away from the trunk toward the periphery of the drip circles. The intensity of root activity was highest during north-east monsoon due to high volumetric soil moisture, and decreased during winter as the rain receded. Least activity was observed during summer due to depletion of soil moisture. Generally the period of high root activity alternated with that of shoot growth except in
significant relationship with the adoption behaviour of the respondents.

Kashem and Mikuni (1998) reported the farm techniques used by the Japanese farmers in achieving sustainable agricultural development. The findings reveal that farmers' use of farm techniques were the highest in rice cultivation followed by vegetables and flowers, and fruits respectively. The use of farm techniques by the farmers had significant positive correlation with their farm size and contact with information sources.

Kotur and Murthy (1998) reported the root activity distribution studies in citrus, grape, mango and guava using isotopic techniques. Soil injection of carrier-free 32 P was used to study root activity distribution in fruit crops. All 4 citrus crops (oranges, 2 types of mandarin, and limes) were shallow-rooted while grape (cultivars Anab-a-Shahi and Thompson Seedless), mango (cv. Aiphoneko) and guava (cv. Arka Mridula) were deep-rooted. The spread of active roots was uniform during north-east monsoon period due to uniformly moist soil mantle. During summer, the active roots moved toward the soil surface and away from the trunk toward the periphery of the drip circles. The intensity of root activity was highest during north-east monsoon due to high volumetric soil moisture, and decreased during winter as the rain receded. Least activity was observed during summer due to depletion of soil moisture. Generally the period or high root activity alternated with that of shoot growth except in
quality inputs and facilities at reasonable cost will be of much use in enhancing practice adoption by cowpea farmers.

Maglinao et al. (1998) reported a review on farmers' reasons for adoption or non-adoption of soil conservation technologies. It provides experience related to the provision of subsidies or incentives in government extension programmes and draws conclusions on their usefulness in facilitating technology transfer and adoption. The case of the rice programme in the Philippines and in Indonesia, and the Integrated Social Forestry Programme in the Philippines, point to some problems in the provision of subsidies as a means of soliciting participation and sustaining adoption of the technologies being introduced. In general, adoption is higher when subsidy is provided but declines when this is no longer available. Similarly, in the on-farm research of the ASIALAND sloping lands network, the participation of project farmers has generally been the effect of the free inputs provided. It is concluded that while subsidies and incentives have been shown to affect technology adoption, these must be looked at in a more holistic manner to consider other contributory factors as well.

Reddy et al. (1998) reported the perception of mango growers about constraints in application of recommended growth regulators. Suggestions from growers to improve adoption rates include: technical guidance regarding application and the provision of credit for the purchase of chemicals and equipment.
Sornsrivichai et al. (1998) reported the beneficial effect of using perforated plastic packages for commercial vapour heat treated mango for overseas shipment and a computerized design for optimum package.

Modified atmosphere (MA) storage using plastic film packaging was used to simulate overseas shipment of Nam Dork Mai mangoes. The proper degree of perforation on plastic film packaging was designed using computer model aided techniques to achieve the desired O₂ concentration according to the fruit weight and package volume. The model used to predict the permeability value of the package film to achieve the equilibrium MA condition was confirmed and validated. The fruits shipped in MA packaging had one additional week of shelf life with better quality at ambient temperature and had a lower percentage of disease.

Suthipradit et al. (1998) reported that despite the considerable amount of improved technologies for sloping upland management that are available, very few of these technologies have been adopted by farmers. The major constraints to technology adoption by farmers on sloping land include the inappropriateness of the technology socio-economically, the inability to generate returns in a short time, inability to solve the problems of farmers quickly, and poor packaging.

Sharma (1998) reported the Punjab farmers' response on control of weeds and fruit dropping in mango orchard. Responses
from 200 farmers in three selected districts of the Indian Punjab State revealed that adoption of recommended technology for weed control in mango (Mangifera indica L.) orchards was very poor. The use of weeds as fodder, high cost of herbicides, lack of technical guidance and lack of time were identified as major constraints in the adoption of recommended practices for the control of weeds and fruits drop in mango orchards. It is suggested that concerted efforts are required on the part of extension scientists working at the grassroots level to promote awareness among mango growers about the advantages of weed control measures. Possible methods considered include: the organization of short-term training programmes, distribution of pertinent scientific literature and the maintenance of regular contract with mango growers.

Reddy et al. (1998) reported the perception of mango growers about constraints in adoption of recommended growth regulators. Suggestions from growers to improve adoption rates include: technical guidance regarding application and the provision of credit for the purchase of chemicals and equipment.

Singh and Chaudhary (1998) reported the factors affecting symbiotic adoption and the impact of socio-psychological factors on the adoption of technology using data collected from 40 farmers (progressive and non-progressive) in Saharsa district, Bihar. Risk, size of holding and aspiration were identified as significant influencing factors.
Shashi Sharma et al. (1998) reported an easy and quick method of breeding flies for pollination of mango blossoms. In studies at Lucknow, Uttar Pradesh, India during 1995-97, perforated nylon mesh bags measuring $20 \times 50$ cm containing fish or mutton pieces were hung on the lower branches of mango trees so as to breed flies for pollination throughout the orchard. Several species of flies were found breeding in the bags, the most numerous of which were *Lucilla* sp. and *Sarcophaga* sp. The bags did not require any maintenance, and thus provide a quick and easy method of pollinator breeding.

Srinivasa et al. (1998) reported the probabilities of adoption of new sericulture technologies among farmers of different socio-economic levels. The study was conducted in Dharwad district of Karnataka state, India. The results showed that adoption of sericulture practices was influenced significantly by education and mass media participation as indicated by their elasticity coefficients. The probability levels of those who adopted the sericulture techniques intensively ranged from 0.43 to 0.61 among various groups of farmers. The reasons for non-adoption of technology in the study area pointed to lack of knowledge as the main constraint (81.30% of farmers) followed by low prices for cocoons (70.50%) and high costs (63.60%) of technology adoption.

Worley et al. (1998) reported the technology adoption decisions in Pacific North-West grain milling firms. Determining,
factors impinging on decisions to change production technology. Five major factors were identified as size of firm, facility location, product offering, form of business organization and corporate attitude to risk. Recommendations aimed at improving technology transfer programs offered by university and government agencies are drawn from the interview results. These recommendations include: targeting industry problems; working with groups of firms, selection of appropriate delivery modes and interchange; and establishing beneficial institutional arrangements.

Abhay Mankar et al. (1999) reported that for quick and better success of stone grafting in mango, the wedge method was superior to splice method and 6 days prior defoliation prior with 3 days storage of bud wood, was the most suitable period of achieving high success and survival of grafts as well as overall growth of the plant, in both the method of stone grafting

Arbindra Rimal et al. (1999) reported the freeze risk and adoption of technology by orange producers. They reported that orange producers in many regions of the USA are affected by recurrence of frost. Large farmers with diversified businesses had lower perceptions of freeze risk than small farmers. Change in crop location and the adoption of anti-frost technology were two important responses to freeze risk. California farmers shifted their location to frost-prone areas and adopted anti-frost technology. Florida farmers,
however, diversified to less frost-prone areas and adopted new planting technologies instead of anti-frost technologies.

Ahmed and Sanjay Singh (1999) reported that post harvest treatments on shelf life of Amraptali mango gave better response regarding extension of shelf life of fruits. Fruits treated with Bavistin 500 ppm and kept in perforated polythene bag and GA3 50 ppm + preformatted polythene bag could be stored well upto 11th days with minimum spoilage loss and the process of ripening was delayed as judged from the pattern of titratable acidity, sugars and β-carotene content.

Benziane et al. (1999) reported that in Morocco, citrus crops occupy an are of 74575 ha, representing 10% of the area under tree plantation. Pests and diseases constitute serious problems of these crops in the sense that the cost of their control reaches 30% of the total expenditure in orchards. In order to reduce the cost of chemical control a strategy of integrated pest management was implemented based on results from previous studies, the use of sex pheromone traps, adoption of intervention thresholds and the releases of parasitoids. This strategy resulted in the reduction of the number of sprays from 10 to 3, and consequently lowered chemical control costs by 47%. Furthermore, the adopted strategy reduced chemical residues in fruits, enhanced the action of biological control agents and limited chemical input into the environment.
Borah and Bhagawati (1999) reported the technology adoption behaviour of fish farmers in five villages within a 40 kg radius of Assam Agricultural University, India (n=250 1997/98). It is observed that although 77.2% or respondents reported adoption of different agriculture technologies, only 26.8% followed the complete package or recommended practices. The most frequently cited reasons for non-adoption/partial, adoption were high investment followed by inadequate availability of finance and of inputs. Educational level and economic status of farmers were found to be positively related with adoption level of agriculture technology.

Barcelon et al. (1999) reported relating X-ray absorption and some quality characteristics of mango fruit. X-ray absorption was used as an index to detect the quality of mangoes, based on its relationship with density, moisture content, soluble solids, titratable acidity and pH. A regression equation was obtained between the computed topography (CT) number and the physico-chemical properties based on the principals of X-ray absorption capacities of the fruit. The CT numbers of intact mangoes were positively correlated with density, moisture content and titratable acidity over the 3-week post-harvest ripening time. The soluble solids and pH were inversely related with CT number. The results suggest that CT number measurements on intact fruit can be used as a non-destructive indicator of mango quality.
suggestions to mango exporters and packing house workers to improve fruit quality.

Desai et al. (1999) reported the constraints faced by mango orchard growers in the adoption of drip irrigation systems. The data were collected during interviews with 175 mango orchard growers from 24 villages. The results of the research revealed that the most important economic constraints faced by mango orchard growers in adoption of drip irrigation sets were: high cost of spare parts, heavy initial expenses for installation of drip irrigation system and lack of capital for covering either area under drip irrigation system. The major technological constraints faced by the uses of drip sets were: frequent clogging of drippers and microtubes requires and jackals, lack of technical know-how, lack of awareness among the farmers regarding the benefits of drip irrigation systems, and difficulties in maintaining water pressure.

Satyanarayan Soni and Kurmvanshi (1999) reported the technological status (adoption pattern) of soybean cultivation and subsequently identify the constraints in adoption/partial adoption of recommended technology. The data were collected from 45 soybean cultivators in Sagar during 1997/98 using an interview schedule. The findings related to overall adoption of modern agricultural technology, indicated that only 13.33% respondents adopted the overall recommended technology. The remaining soybean producers adopted at low or partial levels. Regarding the constraints in
adoption of technology, lack of awareness was the prominent constraint (expressed by 19.25% of total) followed by high cost of inputs (18.50%). Other constraints were: lack of credit facilities, lack of capital and non-availability of inputs at times. Extension activities and institutional facilities could be provided as remedies.

El-Osta and Morehart (1999) reported the technology adoption decisions in dairy production and the role of herd expansion predicated probabilities of adoption were used to simulate the effect of herd expansion on milk production. Results identified age, size, and specialization adoption a capital-intense technology. Education and size of operation positively impacted the decision to adopt a management intense technology. Age, education, credit reserves, size and increased usage of hired labour positively influenced the decisions to adopt a combined capital and management intense technology. Simulation results indicate that if average herd size is doubled, assuming all else held constant, proportionate changes in the numbers of adopters of the different types of technology will result in total milk production increasing by 12%. If herd size is tripled, total milk production increased by 27.2%.

Floyd et al. (1999) reported the adoption and associated impact of technologies in the Western hills of Nepal.

Results are presented of an adoption study conducted in 1994-95 in the western hills of Nepal to determine the level and extent of adoption of 15 selected field crop, horticulture, livestock and forestry
technologies. A sample of 424 households were stratified by agroecological zone and by level of extension input. To determine the distribution of adoption a set of key factors was developed from the stratification and by classifying households according to ethnicity, food self-sufficiency, accessibility, and gender. The level of awareness was generally good, more than 80% of households were aware of the new technologies. Households were most frequently classified as having not tried a technology (25-70%). The dominant reasons for not trying a technology were related to constraints internal to the farming system (typically lack of labour or land). Once technologies had been tried, more than 60% of households adopted them. Adoption was highest for improved maize, wheat and grain legume varieties, improved tree fruit crops and planting of fodder trees. Adoption levels of improved vegetable crops, vegetable and seed production and rabbit farming were low. The level and distribution of adoption were significantly influenced by extension input and by ethnicity and household food self-sufficiency. The influence of agroecological zone, access and gender on adoption were much smaller and more variable across the technologies. The results were compared to those of an extension impact study conducted for the same sample of households in the previous year. There was a significant positive association between households who had adopted new technologies and those that had reported an increase in total
food grain production, fodder supply and increased workload in the
extension impact study.

Fernandez and Jons (1999) reported pest management practices. They reported that because different pest classes may
dominate among different crops and regions, requiring different pest
management techniques to control them, the extent of adoption of
pest management practices varies widely.

Khushik and Smith (1999) reported the analysis of financial
viability of long term investment in mango orchards in Sind province
of Pakistan. A combination of analytical techniques is employed to
provide reliable and accurate information for growers, market traders
and policy makers to enhance mango orchard investment in
Pakistan. Mango production starts during the fifth year after planting
and reaches a maximum level during the 12th year remaining
constant upto the 25th year. Using data collected from 120 mango
growers in Sind, the return on investment in mango orchards was
found to be 18% and 50% against the current rate of interest on
agricultural loans. The ‘pay-back’ period of mango orchards starts
from 3 and 9 years with and without intercropping respectively.
Moreover, analysis indicates that 40 years is the optimum economic
life of the mango orchards, after that there is a decline in production
potential. Finally, sensitivity analysis found that mango outcomes
are more sensitive to variation in prices than the cost of production.
Hence, there is a need to put more emphasis on stabilization of
mango process by improving the existing marketing system and export policy.

**Madhu Khanna et al. (1999)** reported the current status of adoption of a broad range of site-specific technologies, the extent to which farmers are adopting a site specific crop management system, and the likely trends in adoption. Farmer responses reveal that uncertainty in returns due to adoption high costs of adoption, and lack of demonstrated effects of the advanced site-specific technologies on yields and input-use are some of the major reasons for current low rates of adoption and for the piecemeal approach to site specific crop management.

**Nayak et al. (1999)** reported the effects of improved cultivars and modern cultivation practices on production of cauliflower, radishes and bitter gourds (*Momordica charantia*) in the river bed areas of Birbhum district of West Bengal, India, the use of new technology increased production and yields, with percentage returns of 30% more than in conventional system. Cauliflower cultivation was more suitable for farmers with moderate resources, and bitter gourd production, being the least cost intensive, was more suitable for resource poor framers.

**Neeraj Singh (1999)** reported the technology adoption by hill farmers in Shimla district Himachal Pradesh, India and constraints associated with hill farming. The results reveal a wide technological
gap and the need for training and transfer of technology to improve the productivity of hill farming.

Neilsen et al. (1999) reported the response of soil and irrigated fruit trees to fertigation or broadcast application of nitrogen, phosphorus and potassium. Traditionally, broadcast or foliar fertilizer applications have been used to improve or sustain the nutrition of many irrigated, deciduous fruit tree orchards in western North American. Recent developments, including adoption of low-pressure microirrigation systems and planting at higher densities (especially for apple) have increased interest in controlled application of fertilizers directly with irrigation (fertigation).

Palmar (1999) reported the main requirements for the adoption of intensive planting systems, in particular new cultivars, availability of dwarfing root stocks and the quality of nursery trees. The results of 2 grower trails studying different planting densities (1633-3810 trees/ha and 575-1215 trees/ha) of the cultivar Royal Gala on M. 9 (planted in 1993) showed that trunk cross-sectional area was largely unaffected by tree density in the first year, but in subsequent years the suppression of growth became more severe with higher plant densities. Yield/ha mirrored the effects of growth. A density of 2000 trees/ha produced a yield of 80 t/ha by year 5. Fruit quality was good and fruits were large although size decreased at the higher densities in years 3 and 4.
Pandey et al. (1999) reported the adoption of nutrient management technologies for rice production: economic and institutional constraints and opportunities. When semidwarf, fertilizer-responsive varieties became available in the late 1960s, a range of policy and institutional changes were also introduced to exploit the potential of these varieties. As a result, adoption of both high-yielding varieties and chemical fertilizers increased rapidly, especially in irrigated areas. A review of how these policy and institutional changes have influenced adoption of chemical fertilizers is presented using a micro-economic model of technology adoption.

It is argued that fine-tuning of these policy and institutional innovations will continue to be important in further increasing rice yields and farmers' income, especially in rainfed areas where fertilizer use is still very low. In the more intensive irrigated areas, where chemical fertilizer use is already high, change in the paradigm from that of encouraging higher input use to achieving increased input use efficiently is suggested. Based on a conceptual model of the system evolution of the nature or rice production system in Asia, a somewhat targeted approach to the design of technological, policy, and institutional interventions for improving farmers' nutrient management practices is recommended.

Ruf and Lancon (1999) reported the upland farming technology in Indonesia and adoption of technology innovation. The main findings were (1) land conservation techniques have been
widely disseminated in the most fragile agro-ecological upland areas, however, these techniques are only effectively adopted when upland farmers are able to combine them with cropping systems that significantly increase their income, (2) in income generating terms, food crops do not play a major role, except for improved varieties of maize, which are being increasingly adopted, (3) the existence of an accessible market from which farmers can immediately draw an income is a major factor in the adoption of an innovation, (4) relations between population level and available land are complex and must be considered within their historical and dynamic perspective, (5) the spread of tree crops (e.g. Cocoa, cashew nuts, coffee, oranges) is often associated with massive migration, (6) capital constraints are more or less acute depending on the type of innovation and the channel through which they are transferred, (7) at the macroeconomic level, the rate of upland farming systems is closely related to the future of lowland irrigated agriculture. It is emphasized that competitive advantages for upland farmers of trees and vegetables may only exist as long as rice remains the most profitable and least risky crop in irrigated systems. The study concludes by recommending that extension staff circulate among farmers and small holders as much as possible, to accelerate information dissemination.

Reddy et al. (1999) reported the factors affecting technology adoption among the two ethnic farming communities in Fiji (n=78
Fijian farmers and 319 Indian farmers, 1997). Factors included in the analysis are: age, education, wealth, farm size, extension visit, and distance from research station. Estimates from Tobit model and simulation results indicate that the two ethnic communities display different rates of adoption with respect to some of the factors examined. The Indian farmers, known for their savings and investment behaviour display a higher probability of technology adoption for the factors examined than the Fijian farmers. Among other factors, greater uses of extension activities are suggested to reduce the risky perception of adopting a new technology both in the short and long term.

**Sharma and Khurana (1999)** reported the adoption of plant protection measures in mango orchards by the mango growers in Punjab. He reported that the adoption of plant protection measures for the mango was poor among mango growers. In all three districts, the respondents who had adopted chemicals method for the control of insect pests were in the range of 20 to 42.86% and those who had used against diseases in mango were 16.67 to 43.75%. The percentage of the respondents who had applied the recommended doses of insecticides, ranged from 40 to 45% whereas those who had applied the recommended doses of fungicides were 60 to 64.28% in the study area. It is, therefore, implied that the extension officers working at the grass roots level should educate the grower on use of plant protection measures, e.g. through farmers’ days, short-term-
training courses on mango, on the spot guidance etc. Some type of horticultural plant clinic/diagnostic centre at the block level is also required.

Singh and Narayana (1999) reported that high temperature and low relative humidity prevailing at the time of harvesting of Dashehari mango result in an abrupt respiratory rise during climactic phase. This causes fast ripening followed by; softening, shriveling and senescence which in turn reduces the shelf life of fruits. Various efforts have been made to enhance the storage life of mango by harvest the fruit with stalk, then at low temperature and delaying the ripening by calcium application. The mango fruits harvested with stalks (8-10 mm) can be stored successfully upto 27 days at 12°C with 85-90% relative humidity and 6 days at ambient condition in acceptable good condition with minimum spoilage compared with the control fruits (17 days). Though Ca infiltration delayed the ripening, maintained the firmness and reduced the spoilage during storage but he injury caused by Ca infiltration is a limiting factor.

Sharma and Khurana (1999) reported the adoption of plant protection measures in mango orchards by mango growers in Punjab.

It was found the adoption of plant protection measures for the mango was poor among mango growers. In all three districts, the respondents who had adopted chemicals methods for the control of
insect pests were in the range of 20 to 42.86% and those who had used against diseases in mango were 16.67 to 43.75%. The percentages of the respondents who had applied the recommended doses of insecticides, ranged from 40 to 45% whereas those who had applied the recommended doses of fungicides were 60 to 64.28% in the study area. It is, therefore, implied that the extension officers working at the grassroots level should educate the growers on use of plant protection measures, e.g. through farmers’ days, short-term training courses on mango, on the spot guidance etc. Some type of horticultural plant clinic/diagnostic centre at the block level is also required.

She-Yunweil et al. (1999) reported the performance of mango cultivars and cultural techniques in the arid and hot river valley in the Yuri areas. Xiaolusong, introduced from Haiwan province, is the main mango cultivar grown in this area of China. The fruits mature in mid July and have an average fruit weight of 140-170 g. The skin is golden and the flesh is orange yellow, juicy, sweet and aromatic with few fibres and a soluble solids content of 19%. The trees have good pest and disease resistance and are suitable for growing at 1000 m.a. s.l. Yuanjiang Xiangya is a large-fruited cultivar with an average fruit weight of 360-400 g. The fruits have a yellowish red skin and golden yellow juicy flesh with a sweet and aromatic flavour. The trees are not resistant to powdery mildew (Oidium mangiferae) of anthrathose (Glomerella cingulata).
Saraf and Soni (1999) reported the adoption of improved package of practices by citrus growers in Chhindwara district of Madiya Pradesh along with the constraints to adoption.

The data were collected from 100 citrus growers using an interview schedule. The study revealed that 44.25% of the respondents were adopters, 18.55% of respondents were partial adopters and the remaining 37.20% were non-adopters of the improved package of practices in citrus cultivation. The constraints revealed were non-awareness of the technology/improved practices (21.43%). Highly invaded by insect-pests, lack of irrigation water, alternate bearing of crop, high cost of materials and low profitability were also concerns.

Xie-Guogang et al. (1999) reported the key cultural techniques for high production and quality from mango trees.

In studies over 3 decades, orchard site, cultivar selection, pruning and fertilizer and plant growth regulators application were identified as the most important factors for high yields and quality in mango trees. Cultivars Lusongmang, Baiyumang, Baixiangya, Yekiangmang, Zihuamang and Thailand Qingpimang are suitable for growing in Hainan province, China. Spraying with paclobutrazol in late August/early September in the south-western part of Hainan province can promote flowering and ripening date by 1-3 months.

Karan Singh (2000) reported that the education will accelerate the evaluated adoption of new technologies by the farmers and
thereby improving the agricultural productivity in India. Various sources of information are available depending upon the type of information, its utility, urgency and credibility. The informal agricultural extension (by the rural agricultural graduate consistency) has been playing an important role but is diminishing as a potential source for the future. The sustainable growth of agriculture depends upon the sustainable use of natural resources but the farmers and general population has not fully understood and appreciated the long-term implications. The education of “inefficient farmers group” is a potential source of growth. The mass communication methods of agricultural education shall remain of great significance. The non-governmental organizations play a significant role in selective situation. Farmers’ willingness to pay for technology information in specific situations needs to be tapped in making the service effective, reliable, and of improved quality.

Lal and Rajput (2000) reported that the growth of emerging shoots on pruned branches was influenced by severity of pruning. Length and width of emerging shoots were more in first second and third order pruned trees than in fourth and fifth order treatments, whereas it was minimum in the control. Fruit yield was higher in fourth and fifth order pruned trees than the control. Cumulative fruit yield of 6 years indicated that fourth order pruned mango tree gave the highest yield whereas it was lowest in the control.
Surbhi Mittal and Praduman Kumar (2000) reported the impact of rural education on technology adoption, labour employment, use of inputs and yields on rice and wheat crops in India. The study shows that literacy has positive and significant relation with crop productivity, and the presence of strong link between literacy and farm modernization. Literacy emerges as an important source of growth in the adoption of technology use of modern inputs (machine, fertilizers) and yield. It is indicated that in the liberalized economic environment, efficiency and growth orientation will attract maximum attention literacy will play a far more important role than it did in the past. Contribution of literacy, through total Factor Productivity, would be substantial on yield growth and domestic supply. High returns to investment on education is expected. Further agriculture will require modern economic management.

Barman and Pandey (2001) reported the extent of technology adoption and its variation in the production of rice crops in the North Bank Plains zone of Assam. The results indicated substantial technology adoption gaps in terms of irrigation and manuring and fertilization wide inter farm and intra farm variations were observed in the production of soil and also rice.