A comprehensive review of literature is an essential part of any scientific investigation. In this chapter, an attempt has been made to review the related studies critically. The available research work has been presented under following heads.

2.1 Cost and returns
2.2 Profitability
2.3 Resource use efficiency
2.4 factor influencing adoption of intercropping
2.5 Constraints

2.1 Cost and returns

Pooran chand and sujatha (2000) studied the castor is a valuable non-edible oilseed crop palying an Important role in agricultural economy. It is ideally suited for intercropping system, as currently a number of short duration, wilt tolerant/varieties/hybrids are available. Castor was evaluated as a component crop in various legume and non-leguminous crops in 6 : 1 and 10 : 1 row proportions under rainfed conditions. Intercropping of blackgram with castor in 6 : 1 row porportions resulted in the highest LER value of 1.85 coupled with highest yield of castor. Studies also elucidated that there was reductions in the incidence of semilooper and wilt on castor in castor and pigeonpea intercropping system.

Rajput and Verma (2000) studied the production and marketing of groundnut in Khargaone district of Madhya Pradesh. They stated that on an average, main produce yield of groundnut came to 15.33 quintals per hectare. The average value of total output was calculated at Rs. 18089.40. It was highest in medium size group of farms. The cost of production per quintal of groundnut was worked out to Rs. 436.28 on cost A₁, Rs. 448.45 on cost B₁, Rs. 517.55 on cost B₂, Rs. 538.28 on cost C₁, and Rs. 543.81 on cost C₂. Cost C₂was the highest on large size group of farms. The net returns over cost A₁, cost B₁, cost B₂, cost C₁, and cost C₂ were Rs. 10196.80, Rs. 9976.80, Rs. 8726.80, Rs. 8351.80 and Rs. 8251.80 per hectare, respectively. The
average input-output ratio at cost $A_1$, cost $B_1$, cost $B_2$, cost $C_1$ and $C_2$ was worked out to 1:2.29, 1:2.23, 1:1.93, 1:1.86 and 1:1.83, respectively. The returns per rupee of investment were higher on medium size farms.

Shah (2000) studied production and marketing pattern of grapes in Nasik district of Maharashtra in the year 1995-96. The results revealed that the overall cost per acre of orchard was Rs. 42795.24. According to the category of the farmers it was Rs. 40361, Rs. 40608, Rs. 45052 and Rs. 42597 for marginal, small, medium and large farmers, respectively. The respective net returns over cost $C_2$ was worked out at Rs. 38742, Rs. 52148, Rs. 51389 and Rs. 53371 for marginal, small, medium & large category of farmers with an overall average net return was Rs. 52242. It also indicated that as the farm size increases both cost and net return was also increase. The share of material input in gross maintenance cost of production was about 10 to11 per cent. It also found that cost of production per kg was higher in marginal category of farmers because of low productivity.

Khunt et al. (2003) studied economics of production and marketing of pomegranate in Bhavnagar district of Saurashtra region in the year of 2001. Cost of cultivation and net return was estimated for two period; prebearing and economic yield stage. The results showed that the total cost of establishment amounted to Rs. 39586 per hectare. Among the various cost components, the share of material cost was highest to the tune of 41.05 per cent followed by labour cost (27.71 %), rent of land (24.04 %) and interest on working capital (6.59 %). The share of interest on fixed capital and depreciation was negligible. The annual cost of pomegranate cultivation (amortized and maintenance cost) came to Rs. 43930 per hectare. The results revealed that the gross return and net return was Rs. 59488 and Rs. 15558 per hectare, respectively. Furthermore, the important cost was human labour, which had been shown increasing trend with age of orchard. The share of interest on working capital was varied between 6.59 per cent to 8.53 per cent, while labour and tractor charges showed decreasing trend.

Mali et al. (2003) studied the economics of production and marketing of banana in Jalgaon district of Western Maharashtra during the year 2000-01. They revealed that the per hectare cost of cultivation of banana worked out to Rs. 133477.36. Rental value (16.76 %), fertilizer (12.49 %), seed material (12.04 %),
manures (9.54 %) and human labour (8.58 %) were observed to be a major cost. The gross returns per hectare and net returns of banana come to Rs. 214867.24 and Rs. 66761.87, respectively. The cost per quintal of production came to Rs. 250.36, while gross price realized per quintal was Rs. 369.44 and the net price received by the producer was Rs. 341.89.

Srinivas and Sheikh (2006) investigated on possibilities of peanut by considering the planting geometry of castor under rain fed conditions at Hyderabad, Andhra Pradesh. Two sets of intercropping with peanut and pearl millet with intercrop grown during the rainy season of 2001 and 2002. The result compared that the conventional approach, the intercropping of 5 rows of peanut in castor and 3 rows of pearlmillet in castor to maintain 41000/ ha plant population. The maximum net returns Rs. 4698 and Rs. 1072/ha were obtained by intercropping 5 rows of peanut among other row ratio during 2001 and 2002. Among pearlmillet intercropping treatment maximum net return of Rs 6331 and 8948/ha were realized by intercropping 3 rows than the rest of treatment. The relative net return indices established that the profit were statistically superior. The per rupee net returns were vital to the poor farmers were also maximized to 0.64 and 1.40 by intercropping 5 rows of peanut and 1.17 and 1.66 by intercropping 3 rows of pearl millet in castor spaced 180 x 13 and 120 x 20 cm, respectively.

Rane and Bagade (2006) analysed the economics of production and marketing of Banana in Sindhudurg district, Maharashtra in the year 2003-04 using the purposive selection of talukas and villages and 10 farmers from each selected village and 30 farmers from each taluka, representing different size classes of holding were selected randomly. It also inferred that the banana growers were fairly educated. Further this study reported that the cost of cultivation of banana in Dodamarg tehsil was Rs. 1.28 lakh and Sawantwadi tehsil was Rs. 1.15 lakh per hectare, with the benefit cost ratio 2.20 and 2.33, respectively. Among these the major cost was rental value of land followed by seed material, human labour, farm yard manure and fertilizer. Gross return of Dodamarg was Rs. 2.8 lakh and Sawantwadi was Rs. 2.68 lakh. Net return of Dodamarg and Sawantwadi were about Rs. 1.53 lakh.

Jadhav (2007) surveyed 90 summer groundnut growers in Satara district found that, on an average yield of main produce of summer groundnut came to 18.45 quintal
per hectare. The average value of total output was calculated at Rs. 34,898.08. It was highest in medium size group of farms. The cost of production per hectare of summer groundnut at the overall level was worked out to Rs. 15,081.63 on cost A, Rs. 22,852.89 on cost B and Rs. 23,899.22 on cost C. It was highest on large size group of farms. The net returns over cost A, cost B and cost C were Rs. 19,816.45, Rs. 12,045.19 and Rs. 11,008.86, respectively, at overall level. The average benefit cost ratio at cost A, cost B and cost C worked out to 1:2.31, 1:1.53 and 1:1.46, respectively.

Gangwar et al. (2008) made a study on economics of peach cultivation in North Indian Plains. The results showed that the total establishment cost was Rs. 52817 per hectare. The amortization cost over 25 year at the interest rate of 8 and 12 per cent was Rs. 4948 and Rs. 6734 per hectare, respectively. The average maintenance cost as Rs. 13482 per hectare. The average gross return was to be Rs. 25886 per hectare. The ratio of returns to maintenance cost worked out to be 2.09 for peach orchard.

Asmatoddin and Pawar (2008) conducted a study on economics production of papaya in the year 2004-05 in Maharashtra. It is observed that most of the papaya growers were in middle age group (45.67 per cent) and majority of the papaya growers had less than 0.5 hectare papaya orchard with agriculture as main occupation. Furthermore cost A, cost B and cost C were found to be Rs. 76267.04, Rs. 128400.99 and Rs. 136293.49, respectively. In which rental value of land was the highest 33.48 per cent followed by hired human labour (14.45 %), fertilizers (9.04 %), and interest on working capital (6.58 %), irrigation (5.72 %) and family human labour(5.79 %). Results also revealed that growers received Rs. 277542.40 as gross returns of 972.40 quintals of papaya which sold at the price of Rs. 285.42 per quintal. Respective net profit received over cost A, B and C was Rs. 76267.04, Rs. 128400.99 and Rs. 136293.49. Moreover, respectively the farm business income, family labour income, net profit and input output ratio was Rs. 201375.36, Rs. 149141.41, Rs. 141248.91 and 2.03. It was inferred that papaya growers was getting Rs. 1.03 as net profit with the investment of one rupee per quintal cost of production was Rs. 140.16.
Namadev shinde (2008) in Dharvad districts of Maharashtra. The total cost incurred, gross returns generated and net returns realized in different cropping systems were computed in the total cost of production cost of sugarcane sets per hectare was found to be the highest (Rs.9,266.67), followed by hired human labour (Rs.9,233.47), farm yard manures (Rs.89,13.33). Among the different cropping systems, the maximum total cost was observed in CS-I (Rs.73,718.25/ha) and least was in the case of CS-IV (Rs.62,768.96/ha). The cost ‘A’ was found to be the highest in CS-I (Rs.45,366.33/ha), followed by CS-III (Rs.40,596/ha) and CS-IV (Rs.36,572.68/ha), where as cost ‘B’ was the highest in CS-I (Rs.70,799.25/ha) and least in the case of CS-IV (Rs.62,768.96/ha). The gross returns were found to be the highest in the case of CS-I farmers (Rs.11,9546.25/ha), followed by CS-III farmers (Rs.11,9546.25/ha) and CS-II farmers (Rs.96,012.50/ha), the overall average gross returns being Rs.97,929.27 per hectare.

Adinya (2009) examined costs-returns profitability in groundnut marketing in Bekwarra Local Government Area, CrossRiver State, Nigeria. Groundnut marketing is a profitable business, with attractive net return on investment. This study shows that groundnut marketers were faced with severe constraints in their marketing activities. These constraints negatively affect the efficiency of groundnut marketing in the study area. Notable among them are high cost of transportation, lack of capital, lack of extension services, lack of price information, poor market infrastructures, inaccessibility of formal credit source because of high interest rate and lack of roads maintenance/bad roads occupied 15 per cent, 14.17 per cent, 11.67 per cent, 10 per cent, 9.17 per cent, 9.17 per cent and 8.33 per cent, respectively. For efficient marketing of groundnut in the study area, these constraints must be drastically reduced to the barest minimum. This can be done through efficient policy formulation and implementation, proper supervision of groundnut marketing programme, effective extension services and proper agricultural financing. It would pave a way to increase profit and will help alleviate poverty in Cross River State. It is also recommended that groundnut marketers in the study area should form cooperative groups to have access to loans from banks for better capital base for higher output.

Sharma and Zote (2010) studied effect of papaya ring spot virus management technology on economics of Papaya cultivation and revealed that the total overall average gross cultivation cost (cost C) was Rs. 204848 per hectare. The overall
average total (gross) revenue was Rs. 577086 with Rs. 372238 net profit per hectare. Overall B:C ratio was 2.96.

Sharma et al. (2010) studied the economics of papaya cultivation at farmer’s fields and they observed that the total overall average gross cultivation cost (cost C) was Rs. 204848 per hectare. Among them the material cost was accounted as a major cost which was about Rs. 93070 followed by labour cost (Rs. 42685), imputed value of family labour (Rs. 27308), interest on fixed capital (Rs. 23640), rental value of owned land (Rs. 10000), interest on working capital (Rs. 8145) and land revenue (Rs. 500). The overall average total (gross) revenues and net profit were Rs. 577086 and Rs. 372238 per hectare, respectively. Thus, the papaya cultivation was highly profitable in the surveyed area of Maharashtra.

Girei et al. (2013) analyzed the economics of groundnut production in Hong Local Government Area of Adamawa state, Nigeria. Gross margin analysis was used to estimate cost and returns from groundnut production for the study. The findings revealed that male farmers dominated groundnuts farming in the study area which constituted (57 %) of the respondents and the study further revealed that they had acquired one form of formal education or the other. The result also showed that Groundnut production was profitable in the study area as demonstrated by the results which gave total revenue, gross margin and net farm income per hectare N 14,355. The study therefore recommends that for profit maximization, farmers should procure their inputs requirement from a competitive market and should make use of the available organic manure to minimize cost of production.

Prasad et al. (2013) carried out cost return analysis of production and marketing of groundnut in block Behander in district Hardoi (U.P.) The average net income realised was Rs.16151 per hectare. It varied from Rs.12849 per hectare on marginal farm of below 1 hectare size group to Rs.16076 on 1-2 hectare size and Rs.22637 per hectare on 2 hectares and above size group. The benefit cost ratio in groundnut cultivation came to 1:1.41 to 1:1.52 on different size group of farms. The total market surplus of about 28.22 per cent was sold through channel I, while remaining 71.77 per cent throughout the channel II. The producers share in consumers price came a little higher being 87.10 per cent in channel I (Regulated market) in
comparison to channel II where it was 85.31 per cent. Total marketing cost came to Rs.151 per quintal in channel I, as compared to Rs.87 in channel II.

Khorne et al. (2014) study the economics of groundnut production in Amravati district of Maharashtra state. The study revealed that at overall level, the per hectare cost of cultivation of summer groundnut was worked out to Rs.73737.76. It increased with increase in size of holdings from Rs.71720.4 on small to Rs.75588.97 on medium sized farms. The study also revealed that, at overall level, the output-input ratio which indicated the profitability of investment as observed to be 2.37 at Cost A, 1.48 at Cost B and 1.39 at Cost C.

Mane et al. (2014) studied the cost, returns and profitability of summer groundnut in Hingoli district of Maharashtra. They revealed that groundnut required higher quantity of irrigation and hired human labour per hectare on both TAG-24 and SB-11 groundnut farms. Per hectare cost of cultivation of TAG-24 was Rs.84818.47, while that of SB-11 was Rs. 83123.46. Gross returns from TAG-24 and SB-11 were Rs.137411.83 and Rs.99312.74 respectively. It was observed that, farm business income was Rs.82098.70 and Rs.43600.58 from TAG-24 and SB-11, respectively. Per quintal cost of groundnut production was higher as Rs.3668.35 for SB-11 groundnut, while that was Rs.2654.57 for TAG-24 groundnut. TAG-24 was higher profitable than SB-11. Output-input ratio of TAG-24 was 1.62 per cent while that of SB-11 was 1.19 per cent.

Raut et al. (2015) conducted experiment in Talod and Himatnagartalukas of Sabarkantha district of Gujarat state for estimating the cost of groundnut production. Net income over cost-C2 was the highest for large farmers followed by medium farmers and small farmers. The total cost and gross return over cost-A1, cost-B1, cost-C1 and cost-C2 of small farmers was highest and decreased with increase in the size of holding.

2.2 Profitability

Kumar and Singh (2003) studied the profitability and financial viability of mango and kinnow plantations in Himachal Pradesh in the year 1998-99 and observed that the initial investment for raising mango plantation on one hectare (100 plants) was Rs. 5229. Of which the total variable cost accounted for 45.71 per cent and the
total fixed cost 54.29 per cent. The rental value of owned land was the most important component of initial cost accounting for 41.92 per cent followed by planting material and human labour. In case of kinnow plantation (one hectare, 450 plants), the initial cost was Rs. 12683 in which the total variable cost and fixed cost accounted for 71.60 per cent and 28.40 per cent, respectively. Among the total cost human labour cost was the major cost, which accounted as 23.38 per cent followed by planting material and rental value of owned land. The total establishment cost per hectare for mango and kinnow plantations was estimated to be Rs. 28202 and Rs. 29658, respectively. The output input ratio ranged between 1.06 to 5.35 in case of mango and 1.46 to 3.15 in case of kinnow, it suggested that both plantation were profitable.

Langat et al. (2006) carried out study at Busia Farmers’ Training center in Kenya during the short rains of 1998 and long rains of 1999. The objective was to come up with groundnut-sorghum intercropping spacing that is appropriate in land use, yield, and monetary returns compared to mono-cropping. The study showed that the populations of groundnut and sorghum in the intercrop affected their performance. The highest sorghum grain yield (3846 kg/ha) was found in GS4 (two groundnut rows alternated with two sorghum rows) in 1998 and in GS3 (one groundnut row alternated with two sorghum rows) with 3825 kg/ha in 1999. The highest groundnut yield was realized in GS2 (two groundnut rows alternated with one sorghum row) with 1045 kg/ha in 1998 and 790 kg/ha in 1999. In terms of land use, GS4 was the best pattern, with LERs of 2.12 (1998) and 2.01 (1999). Similarly, the highest profits were also from GS4 in both seasons. Therefore, for maximum use of land and with no crop preference, GS4 was the best combination to use.

A study conducted by Department of Agricultural Economics, JAU, Junagadh (Anonymous, 2009) on profitability and viability of sapota orchard in Saurashtra region. The result revealed that the total investment cost was Rs. 1440501. Among this the major cost was the land value which constitute about 90 per cent. The total overall per hectare establishment cost was Rs. 41732. Among the various cost components, the share of land rent found the highest accounted as about 32 per cent followed by labour, materials and interest on working capital. The total annual per hectare cost incurred was Rs. 69904 which comprised of Rs. 19252 as amortized cost
and Rs. 50652 as maintenance cost. The average annual net return was Rs. 58777 per hectare.

Taru et al. (2010) examined the profitability of groundnut production in Michika Local Government in the study Area of Adamawa state, Nigeria. Gross margin analysis was used. From the costs and return analysis, it was found that the total cost of production by farm size per hectare in the area was Naira 133,812.68; the gross margin per hectare was Naira 22,1348.68, while the average net return per hectare was Naira 40,097.63. The findings also showed that, farmers in the area earned an average net revenue ranging between Naira 17,217.00 and Naira 445,011.35 depending on farm size which indicated that groundnut production is a profitable venture in the study area. Farmers should maintain output per hectare at a high level with the family labor at their disposal through good management and efficient use of modern inputs. Farmers with no family members should join communal labor arrangements, where they will benefit from it for their farm operations.

Ani et al. (2013) examined the profitability of groundnut production in Benue state of Nigeria. The key variables that influence profitability are hired labour, cost of seed, agrochemical and cost of fertilizer. This could be attributed to high demand for labour, land and agrochemicals which are the critical factors that play a significant role in groundnut production. The socio-economic factors that affect groundnut production in the study area include farmer’s age, household size and annual income. Similarly, an average farmer spent (28 %) above the minimum frontier cost. Furthermore, the elasticity of cost of production with respect to cost of hired labour and cost of seed was found to be relatively high indicating their importance in groundnut production. More land should be put into groundnut production and farmers should be given essential agricultural inputs that will enhance the productivity of this cash crop. The study further recommends the development and dissemination of simple machines that can facilitate the stages involved in the production of groundnut.

Alhassan and Egbe (2013) conducted an experiment in Makurdi, Nigeria, to determine the suitability of some landraces of bambara groundnut for intercropping at varying planting densities with maize. Intercropping decreased number of pods and grain yields of bambara groundnut component. Number of pods and grain yields
increased with increased planting density. Productivity indices indicated that, bambara groundnut/maize intercropping was productive and maize was the dominant component. The marginal rate of returns for the best combinations was 116.13 per cent suggesting profitability of the intercropping systems.

Alexson et al. (2015) in brazil carried out experiment to evaluate advantages, yield, cost of production and profitability in the intercropping castor/peanut as a function of sowing time. The yield of both crops as well the profitability of the cropping systems, cost of production and competitive rates were evaluated. The grain yield of both intercropped crops was affected when the sowing time was expanded. There was better castor yield in longer sowing time compared to peanut.

Bathon et al. (2015) examined the profitability of groundnut–based cropping systems among farmers in Hong Local Government Area of Adamawa State, Nigeria. Specifically, the socio-economic characteristics of the farmers were described, their cropping systems identified, and the profitability of groundnut based cropping systems determined. The results revealed that majority (60 %) of the farmers were female, having an average household size of 8 people and had some level of formal education. Two groundnut-based cropping systems were identified, namely; groundnut/sorghum and sole groundnut cropping systems. The analysis of cost and returns revealed lower total variable cost in groundnut/sorghum enterprise, while that of sole groundnut enterprise was found higher in the returns from production, the total revenue from groundnut/sorghum production was found more than while that of sole groundnut enterprise. At the same time the profit from groundnut/sorghum production was found to be lower than that of sole groundnut production, indicating the latter to be more profitable than the former. Sole groundnut production had higher profitability index, higher rate of return on investment and higher rate of return on variable cost, than groundnut/sorghum production. Based on the findings, the study recommended that farmers cultivate groundnut solely. Government and donor agencies should encourage groundnut breeding researches, so as to raise the productivity of existing groundnut seeds.

Elameen and Elrasheed (2015) examined the profitability and competitiveness of the main crops grown under the rain-fed sector of Gadarif state Nigeria, viz, sorghum, millet, sesame and groundnuts. Results revealed that, the four grown crops
in the study area were proved to be financially and socially profitable, despite the
discouraging policies. The taxes on domestic input transfer for the four crops and
output for groundnuts negatively affects the profitability, competitiveness and
comparative advantages of all crops and give fragile results under shocks, except
sesame which showed strong results under all conditions. Policy-wise, government
should reduce taxes and provide incentives for farmers participating and adopting
extension programs. It should also invest on the infrastructure to link farmers to a
high value markets. Likewise, they should expand microfinance to cover all farmers.

Mohammed et al. (2015) conducted a study on groundnut profitability in Yobe
state, North-Eastern, Nigeria. The results showed that most respondents were literate
and experienced farmers. There were similarities in input usage between the rain fed
and irrigated farm operators. Profit indicators showed that rain-fed and irrigated castor
farmers made profits. Short-run profits were determined by decreases and increases of
input costs and output price, respectively in both production systems. Output price in
both production systems was found to have had higher marginal effects on profit than
input costs.

Taphee et al. (2015) analysed the profitability of groundnut production in
Northern Part of Taraba state, Nigeria. Results revealed that most farmers (75 %) are
young, mostly females (57.50 %) and educated (75 %). It also showed that the total
revenue (TR), gross margin (GM) and net farm income (NFI) per hectare were found
varying among different farm households. The study also recommended that
government should re-introduce commodity board and advised that farmers should
form cooperatives groups in order to facilitate access to modern farm inputs as well as
credit facilities from lending institutions to the farmers.

Chaudhari et al. (2017) examined the profitability of groundnut–based
cropping systems in junagadh of gujarat state. The productivity in terms of groundnut
pod equivalent yield was significantly higher with groundnut + pigeonpea followed
by groundnut + castor and groundnut + cotton than sole groundnut and other
intercropping systems. The economics of the systems also indicated that groundnut +
pigeonpea was most profitable system in terms of gross return and net return, over the
groundnut + castor and groundnut + cotton.
2.3 Resource use efficiency

Patil et al. (1997) examined the resource use efficiency in groundnut production of Dharwad and Hublitalukas of Dharwad district of Karnataka. The Cobb-Douglass type of production function was used to study the resource use productivity. The results indicated that the regression coefficient with respect to seeds was highly significant in all categories of farms. Regression coefficients with respect to expenditure on plant nutrients were significant except of large farmers. The expenditure on plant protection chemicals was positive in all the categories of farms. The ratio of marginal value product to factor cost was greater for all the inputs used in groundnut production indicating scope to increase the use of these resources.

Gaddi et al. (2002) studied resource-use efficiency in groundnut production in Dharwad district, Karnataka. The study revealed that the average level of resource use efficiency achieved by the sample farmers in groundnut production was fairly high. There is scope to pushup groundnut production, as most of the inputs were underutilized.

Taru et al. (2008) examined the economic efficiency of resource use used in groundnut production in Michika Local government area of Adamawa state, Nigeria. It focused on the relationship between groundnut out and the various inputs used by groundnut farmers, elasticity and economic efficiency of resource used in production of groundnut. This implied that 78.84 per cent of the total variations in groundnut yield is explained by combine influence of all the explanatory variables (farm inputs) in the regression equation. Economic efficiency of resource used showed that the seed and labour were underutilized, while fertilizer and agrochemicals were over utilized.

Majumder et al. (2009) studied the measure and compared resource use efficiency and relative productivity of farming under different tenure conditions in an area of Bholadistrict in Bangladesh. The study explored the difference in the efficiency and productivity among owner, cash tenant and crop share tenant. Total cash expenses as well as total gross costs for producing HYV Boro rice was highest in owner farms and lowest in crop share tenant's farm. When individual inputs were concerned it was observed that expenses on human labor shared a major portion of expenses in the production of HYV Boro rice, where owner operators used more hired
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labor in compare to other groups. However, the cash tenant farmers were more efficient than owner and crop share tenant farmers. Due to poor resource base, the crop share tenants were unable to invest on modern farm inputs. It may be mentioned that in Bangladesh the predominant tenancy arrangement is share cropping, which is an inefficient form of tenure arrangement as compare to cash tenancy.

Jirgi et al. (2010) examined the profitability and resources-use efficiency of millet/cowpea mixed farmers production in Niger state, Nigeria. The results showed that the estimated gross margin and net farm income, gross ratio, operating ratio and returns on investment were N57, 542.42 per hectare, N54, 240.40 per hectare, 0.37, 0.31 and 2.15. The resource use efficiency results showed that seeds, family labour and agrochemicals were under-utilized. Farm size and hired labour were over-utilized. Efficiency and productivity could be improved if the farmers use more seed, family labour, agrochemicals, less of hired labour and land.

Kapopo and Maganga Assa (2012) examined the resource use efficiency in small scale groundnut production in Kasungu district, Malawi. A household survey was administered to 42 groundnut farmers in Northern part of Kasungu district. The study has established that a farmers return MK 2 for every Kwacha invested. The farmer incurs MK 95 for every Kg of groundnut produced. The foregoing analysis of production function indicated that farm size, seed and labour are the important factors of production that affected groundnut output in the study area. The regression coefficients of these inputs were positive and statistically significant. Farm size had the highest MVP as compared to other inputs. Seed was the second production factor with higher MVP indicating that farmers can increase their groundnut output by using optimal seed rate. The main constraints to marketing included low output prices and poor (unstandardized) measurement scales.

Shakuntala and Suhasini (2013) analyzed the resource use efficiency of castor cultivated in Mahbubnagar district in Andhra Pradesh. The results of Cobb Douglas production function revealed that the farms are under increasing returns to scale (1.326) indicating the scope for improvement in yields. Among the inputs, positive and significant were machine labour, farm yard manure and plant protection chemicals (0.211, 0.363 and 0.34), which can be increased in quantum for increasing the yields.
Bullock labour component was excessively used as confirmed by negative production elasticity of 0.102. The coefficient of multiple determination was 66.4 \textit{i.e.}, 66.4 per cent of the variation in output was explained by the variables considered. Farmers opined that if good management practices are adopted, with quality of seed, resistant to diseases \textit{viz.}, wilt and botrytis and emerging pests like capsule borer, yields can be better. The study concluded that castor can be considered as a suitable alternate under tank areas whenever paddy cannot be grown due to insufficient water.

Zekeri and Tijjani (2013) measured the resource use efficiency in groundnut production in Ringim Local Government Area, Jigawa state, Nigeria. The data collected were analysed using production function and efficiency model. The linear production function analysis showed that the coefficient of multiple determination \((R^2)\) of the production was 76.5 per cent, while the \(F\) value was 27.6. The analysis revealed that among the variables, seed, hired labour and pesticide use in the groundnut production were significant \((p<0.1)\), while fertilizer, family labour and farm size were not significant. The returns to scale were 1.77. For resource use efficiency, seeds, family labour and hired labour were underutilized, while fertilizers and pesticides were over-utilized. It was concluded that in spite of their small farm size, there was still opportunity to increase their production to attain optimal economic efficiency. The study recommends that farmers should be encouraged to use more variable inputs to get more profit and youth should be encouraged to participate in groundnut production.

Gezahagn (2013) studied economic performance of groundnut production in East Hararghe zone of Oromia regional state, Ethiopia. It focused on technical relationships between groundnut output and different inputs, economic resource use efficiency and cost benefit analysis. The result for the study was based on primary data generated from 86 randomly sampled groundnut farm households at different stage by means of structured and semi-structured questionnaires. From the total of seven explanatory variables to be estimated by using Cobb- Douglas function, quantity of seed, labor and livestock in tropical livestock unit were significant at different significance level and they showed positive effect on groundnut output. The economic efficiency of resource used showed the seed, fertilizer and labour were underutilized and land was over utilized.
Reddy Lokanadha and Reddy Radhakrishna (2014) observed the resource use efficiency of input factors with reference to farm size in groundnut cultivation in Nellore district of Andhra Pradesh. He showed the crop-wise production function analysis clearly indicate many points, which were not evident in aggregate and size wise models. But crop-wise analysis was a firm of aggregate model as the output of crop coming from different size enterprises has been put together. Land is an important factor for production and its effect on technology must be fully emphasized. It is only an inter-size analysis of production function for a particular crop, which can do away the limitations of an aggregate crop model. Inter-size crop models would also indicate the relative superiority of different crops for different size-group of farms that it is helpful for crop-cum-size level planning.

Singh et al. (2014) examined the resource-use efficiency aspects of groundnut crop in Rajasthan. Among the all factors of production seed, fertilizers, irrigation and human labour observed as key factors in production of groundnut with 78 per cent $R^2$ values showed that the factors involved in production have great role in increasing the production of groundnut. The key factors such as seed with coefficient 0.35, fertilizers 0.23, irrigation 0.36 and human labour 0.62 indicated that increases on these variables have great scope in increasing the production. The coefficients of these inputs indicated that as rupee one (unit) spent on seed, fertilizer, irrigation and human labour in production of groundnut crop would add about Rs.141, Rs.41, Rs.632 and Rs.40, respectively to the value of marginal productivity in groundnut crop. Thus, investment on these inputs adds considerable amount in value of marginal productivity in groundnut crop in the study area.

Gideon et al. (2015) studied efficiency of resource use by collecting cross-sectional data from 120 groundnut farmers in the Tolon district of the Northern region, Ghana, during 2013 major cropping season. It focused on identifying the determinants of groundnut output growth, measuring the technical efficiency level of the farmers as well as how efficient farmers are with respect to the allocation of their inputs. The stochastic frontier analysis (SFA) was employed to examine the determinants of output and measure the technical efficiency level of farmers, while the marginal value product, marginal factor cost (MVP-MFC) approach was used to ascertain whether farmers are efficiently allocating their resources or not. The results
from the stochastic frontier analysis indicated that labour and quantity of seeds exerted significant and positive effects on groundnut output, while the area of land allocated to groundnut cultivation had negative and significant effect on groundnut output. Groundnut farmers in the study area had a mean technical efficiency score of about 84 per cent indicating an output loss of 16 per cent, due to inefficiency. Various sources of efficiency include; education, farming experience, household size, membership of farmer-base-organization and farmers contact with extension personnel. Allocatively, farmers were over-utilizing labour and seeds sown while under-utilizing quantities of herbicides. The study therefore recommends that an effective farm level training programmes for rural farmers through an effective extension services could increase farmer’s efficiency level and hence increase their profit level.

Madaki et al. (2015) examined the resource use efficiency of groundnut production in Biu Local Government area of Borno state, Nigeria. The regression analysis showed that the coefficient of multiple determinations, $R^2$ was 85.6 per cent, while $F$– value was 36.5. It also revealed that among the variables seed, farm size and family labour used were significant ($p<0.001$, $p< 0.01$, $p< 0.01$), respectively. It is recommended that farmers should be encouraged to use more variable inputs to get more profit.

Ramjilal et al. (2017) The study was conducted in Porbandar districts of Gujarat. The objective of study also examines trends, costs and returns structure, resource use efficiency in Porbandar district of Gujarat. The functional analysis was also carried out by using Cobb-Douglas type of production function. Further the study revealed that area, production and productivity in case of kharif groundnut decline. The per hectare cost of cultivation for kharif groundnut was ` 50,434.33. Total benefit cost ratio of kharif groundnut was 1.12. The results of production function analysis indicated that the selected seven variables jointly explained 0.78% variation in production under kharif groundnut. The human labour($X_1$), manures($X_4$) and phosphorus ($X_6$) fertilizer in kharif groundnut are significant variables. This indicates that there is scope to increase the use of these resources to increase the production. The results of resource use efficiencies indicated that the MVPs of human labour, manures and phosphorus in kharif groundnut were more than unity. It indicates that,
there is scope to increase input level of these resource variables to maximize the output.

2.4 Factor influencing adoption of intercropping

Mutibo (2011) examined that farmers in Magoye area in Zambia were using two types of cultural practices to control insect pests in their cotton fields, these were; crop rotation (72.5 %) and intercropping plus crop rotation (27.5 %). The intercrops were grown either as a strip/single row pattern alongside the cotton crop or in between each row of cotton. The farmers in this area were using four different types of crops namely: maize, cowpea, beans and groundnut with cowpea and beans being the most common combination (22 %) of intercrops used. Qualitative responses to the survey indicated that the gender and educational level of a farmer were one of the main factors that affect a farmer’s willingness to adopt intercropping.

Bello et al. (2012) examined that low level of education and advanced age of the respondents contributed to low level of technology adoption in Nasarawa state, Nigeria. Fertilizer application (87.50 %), spacing technique (82.29 %) intercropping practice (71.88 %); and storage measures (70.83 %) were accorded varying levels of high adoption by respondents. This study recommends that technologies dissemination to farmers should be based on potential economic benefits, while requisite inputs should be made available and accessible to farmers on time and at affordable price.

Muzari et al. (2012) showed that factors affecting technology adoption are assets, income, institutions, vulnerability, awareness, labour, and innovativeness by smallholder farmers in Africa. Technologies that require few assets, have a lower risk premium and are less expensive have a higher chance of being adopted by smallholder farmers. There are certain traditional smallholder agricultural technologies in sub-Saharan Africa that also have their own merits. Some of these technologies are more efficient in their use of scarce production resources than modern technologies. Modern researchers should therefore seek to understand the rationale behind traditional smallholder farmer behavior in technology use. This will make their future technological interventions in smallholder agriculture more effective.
Chuthaporn Ngokkuen and Ulrike Grote (2012) in Germany studied the geographical indications (GIs) have gained increasing interest since their protection has been ensured multilaterally under the TRIPS Agreement of the World Trade Organization (WTO). Thung Kula Rong-Hai Thai Hom Mali Rice (TKR) is the first officially registered GI Jasmine rice in Thailand. This paper aims at identifying factors that predict the behavior of Thai Jasmine rice farm households in adopting GI certification. Primary data of 370 Thai Jasmine rice farm households were collected through a formal survey in two districts of the Thung Kula Rong-Hai (TKRH) area. The results of the logistic regression analysis indicate that social and human capital variables significantly influence the decision of Thai Jasmine rice farm households to adopt GI certification.

shanmugapriya et al. (2014) in Tamilnadu. The organic food industry in India remains export oriented. Though the production is growing rapidly, yet the domestic market still remains relatively small. The information on consumer preferences for organically grown fresh vegetables could be expected to provide perspectives on increasing organic domestic consumption. Thereby, an attempt has been made to investigate the factors influencing the consumer preference to purchase organic vegetables in the Coimbatore city in Tamil Nadu. Results indicated that consumers with high income, higher education and relatively older in age prefer to purchase organic vegetables. Logistic regression analysis revealed that age; education; health awareness levels; and income of the consumers along with price of the produce; distance of the market and availability of the produce are important factors in the consumer preference of organic vegetables. Garrett’s ranking technique was employed to explore the constraints perceived in the purchase decision of the organic produce. Price of the produce was perceived as the major constraint followed by inadequate availability and lack of information.

Arthi et al. (2016). The study has examined profitability, sources of productivity improvement and determinants of a new technology – Sustainable Sugarcane Initiative (SSI) adoption in sugarcane cultivation in Tamil Nadu by collecting primary data from 120 sugarcane farms during 2014-15. Although the cost of cultivation has been found higher in SSI method vis-a-vis conventional method, the cost of production is lower due to 26 per cent more cane yield. The cost and return analysis has indicated that sugarcane cultivation is more profitable under SSI method than under the conventional method. The decomposition analysis has shown that the
inputs, viz. fertilizers, micro-nutrients and deployment of labour are the major sources of productivity enhancement in the SSI method. The estimates of logit model have indicated that farmers educational level and experience are the major determinants for adoption of SSI method in sugarcane cultivation. The major policy options suggested to improve production and profitability of sugarcane include provision of drip irrigation with subsidy, ensuring timely availability of critical inputs and imparting periodical trainings to farmers on SSI method such as fertigation, wide row spacing, etc.

Ekepu and Tirivanhu (2016) examined socio-economic factors influencing adoption of legume-based multiple cropping systems among smallholder sorghum farmers in Soroti, Uganda. Results showed that 51.7 per cent of the respondents had adopted sorghum-legume rotations compared to only 8.3 per cent who adopted sorghum-legume intercropping. Number of extension contacts had a positively significant (p<0.05) effect on adoption of sorghum-legume rotations, whereas family size had a negatively significant (p<0.05) effect on adoption of sorghum-legume intercropping. From focus group discussions, market access to legume crops also emerged as a barrier to adoption of legume-based multiple cropping systems. The study recommends strengthening legume value chains; improving extension service delivery and conducting a cost-benefit analysis of adopting legume-based multiple cropping systems. The implication to extension service delivery is that extension agents should focus their technology dissemination messages on technologies that are accepted and feasible in their farming communities.

Govindasamy et al. (2017) in the state university of New Jersey. The primary objective of this study was to develop and econometric model to identify a prospective participant who is likely to participate in the hayride agritourism activity. An Internet survey was conducted in the mid-Atlantic United States to collect information from those who participated in direct marketing, visits to agritourism operations and farm events. This study examined the influence of demographic characteristics on the likelihood of participants to engage in a hayride event during an agritourism visit. A total of 1,134 respondents from New Jersey, Delaware, and Pennsylvania completed the survey. A logit model developed to predict demographic characteristics of participants who are likely to participate in the hayride agritourism activity. Approximately 67% of respondents participated in hayrides during
agritourism visits, and based on model results, respondents were more likely to participate if they lived in suburban areas, were male, between age 21 and 50, had a two-year college degree, and had an annual household income between $40,000 and $59,999. However, those who lived in urban areas, have lived at their current residence for more than 20 years, were under age 20, and who have a graduate degree were less likely to participate in a hayride agritourism activity. Hence, farmers may be able to target these subgroups of general population to improve participation in hayride agritourism activity at their farm.

2.5 Constraints

Willey (1979) examined in Ethiopia that in the most cases the main crop in an intercropping system was not reached as high as yield in a monoculture, because there was competition among intercropped plants for light, soil nutrients and water. This yield reduction may be economically significant if the main crop has a high market price than the other intercropped plants. Another disadvantage that is likely to be occurring is the higher cost of maintenance, in particular, weeding, which may have to be done by hand. This is not a serious problem in countries where excess farm labor is cheap, for example Ethiopia countries lacking such a labor force, and intercropping will result in increased costs. Furthermore, harvesting of one crop may cause damage to the other. Finally, the intercropped canopy cover may result in a microclimate with a higher relative humidity conducive to disease outbreak, especially of fungal pathogens.

Tak et al. (1991) identified the major constraints in adoption of recommended technology of kharif groundnut in Marathwada region as non-availability of bullock and human labour in all size groups, knowledge of application of F.Y.M. in case of small farmers followed by medium farmers. Non-availability of cow dung was reported by 86 per cent of the large size farmers and 78 per cent by medium size farmers. Lack of knowledge regarding seed rate and non-availability of seed were the main constraints reported by sample farmers. About 67.83 per cent farmers reported that they were ignorant about the recommended seed. Knowledge regarding seed treatment was the major constraint and it varied inversely in size group, non-availability of insecticides was the main constraint for large farmers followed by medium size farmers. Timely application of fertilizers was the constraint for about 14
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to 40 per cent of the farmers. Financial constraint was observed in the case of 5 to 24 per cent farmers. As regards spraying of insecticides, the knowledge was the constraint and noted in the range of 21 to 28 per cent. Non-availability of sprayers and dusters was a main problem in small farmers followed by medium and large farmers.

Tyagi et al. (1993) observed that, oilseeds and pulses were grown under number of constraints in India such as their cultivation is mainly under rainfed conditions and subjected to the vagaries of monsoon and grown on marginal and sub-marginal land, neglect to their genetic improvement, large number of imperfections in their marketing with the consequent low productivity and low producer's share in consumer rupee.

Fujisaka (1994) examined upland agriculture in SouthEast Asia has been associated with resource-poor farmers, land degradation, soil and water losses, and increasing pest problems. Research and extension have offered farmers on-farm innovations often forms of ‘agroforestry’ intended to improve sustainability of upland agro ecosystems. Farmer adoption, however, has been minimal. Based on case materials, six overlapping reasons why farmers do not adopt are that farmers do not face the problem targeted by the innovation, farmer practice is equal to or better than the innovation, the innovation does not work, extension fails, the innovation costs too much, and ‘social’ factors. Learning from such reasons, our work in the Philippines is hopefully leading to farmers’ adaptation and adoption of contour vegetative strips for soil erosion control.

Adam (2000) observed the crucial constraints of the groundnut production in Nyala Province, South Darfur state, Western Sudan. He observed the scarcity of credit and its high cost and in sufficiency of animal drawn implements during the ploughing period. The study recommended that future efforts should be put on increasing the number of animal drawn implements for each producer, i.e. a plow and a hoe for each producer strengthening the extension department to play its role, and improving the markets. Further, he opined that research must include the other areas of the region, especially the Eastern and Southern provinces.

Singh et al. (2008) identified the constraints faced by farmer of intercropping growers in Panjab state. He was found major constraints faced by the farmer were lack
of price in market, storage facility is inadequate, and market price is not enough were reported the major contraints.

Singh et al. (2011) revealed that drought, lack of quality seeds, poor irrigation facilities, price variability, storage losses due to rodent attack and shortage of labour were the major abiotic constraints. Incidences of diseases and insect-pests attack were the major problems. The marketed surplus was 88.85, per cent, out of which 84.8 per cent was sold immediately after digging in the local market at the price of Rs.15.28 per kg and 3.68 per cent was sold in future at the price of Rs.17.61 per kg. There is an urgent need to develop necessary infrastructure for storage, so that farmers can sell their produce in future at remunerative prices. Quality seed should be made available along with development of irrigation facilities. In order to stop distress sale and price variability government agencies should come forward to ensure good returns to the growers.

Shivalingaiah and Reddy (2012) observed the yield gap, adoption pattern analysis and production constraints of groundnut growers of Tumkur district of Karnataka. The major production constraints perceived by the groundnut growers were high cost of inputs (95.33 %), non-availability of improved seeds in time (93.33 %), erratic distribution of rainfall (92 %), non-availability and improper application of micronutrients (90.66 %), high cost of plant protection measures (89.33 %). The possible suggestions made by the growers were availability and supply of improved seed, bio fertilizers at right time and at reasonable price, developing labour saving tools, developing high yielding short duration varieties, drought tolerant and disease resistant varieties, providing crop insurance.

Chhodavadia et al. (2013) carried the survey in Saurashtra region of Gujarat to know the constraints faced by the farmers in adoption of groundnut-pigeonpea relay cropping system on a sample of 104 farmers. It was observed that the most important constraints were not getting remunerative price of crops (Rank I), high price of improved seeds (Rank II), lack of irrigation facility (Rank III), high price of chemical fertilizers (Rank IV), non-availability of finance in time (Rank V), high price of weedicides and high price of fungicides/pesticides (Rank VI), more labour requirement in groundnut-pigeonpea relay cropping system (Rank VII), non-availability of extension worker in villages as per time schedule (Rank VIII), due to
the adoption of recommended sowing distance, the inter-culturing operations become different (Rank IX) and unawareness about the recommendations of pesticides and fungicides (Rank X). To overcome these constraints, important suggestions offered by the majority (70 %) respondents were: remunerative price of the product should be made available (Rank I), farmers should be protected by crop insurance, if crops fails (Rank II), inputs should be made available at subsidized rate (Rank III) and multiple resistance varieties should be developed (Rank IV).

Chala et al. (2014) studied the opportunities and constraints of groundnut production in selected dry lands of Ethiopia. Groundnut production in Ethiopia is found to be constrained by several biotic and abiotic factors i.e. critical moisture stress especially during flowering and then after, lack of improved varieties and appropriate production and post-harvest practices, and diseases affecting both above- and underground parts of the plant. The disease problem was quite widespread in almost all groundnut producing regions and the fungi aspergillus and associated mycotoxins were found to be very critical both in terms of occurrence, geographic distribution and intensity. The mycotoxins are known to pose health risks to consumers.

Singh et al. (2014) analysed the constraints in production of the groundnut crop and revealed that all the production problems were common in the study area. The timely not availability of labour, irrigation supply, electricity, lack of storage facility at the farm level, weeding problem, unawareness of seed rate were the major constraints identified in production of oilseed crops.

Chavda (2015) examined the adoption of groundnut based inter / relay cropping system by groundnut growers in Junagadh district of Gujrat.It showed that the gap between the know–how already attained and their application in fields is still quite large, despite of considerable advancement in groundnut bases inter / relay crop production technology. There is a wide scope for increasing the production of groundnut based relay crop. The yield of groundnut based relay crop is very low due to non–adoption of latest agricultural technologies of this crop by the groundnut based relay crop growers. However, groundnut based relay cropping system is generally not adopted perhaps because the farmer are reluctant to risk reducing the yield of groundnut, which is a high value crop. Majority of the groundnut based inter crop
(groundnut + castor) growers (74.42 %) and relay crop (groundnut + pigeonpea) growers (76.20 %) were medium adopters of the improved crop production.

Singh et al. (2015) studied the area the incidence of disease pest and wild cow and pigs are frequent. Tikka disease cause huge yield loss in groundnut crop due to defoliation. White grub causes high yield loss in groundnut crop. The high cost of quality seed might be due to the fact that in recent year, with the rise in the incidence of insects, pests and wild animal conflicts, the price of groundnut and castor get fluctuate at the time of selling in to the market as compare to other crop like cotton and therefore farmer prefer not to cultivate groundnut. This might have led high seed cost. The high cost of labour was due to scarcity of labour in peak season, in entire Gujarat.