CHAPTER – II

REVIEW OF LITERATURE

This chapter is captioned review of literature which covers the contents of the selected literature review.

The process of tribbling through the relevant literature imparts some sort of confidence in the researcher and as a result the investigator would get a clear portrait of the area or problem

(Agarwal, J.C. 1996)

A broad review of literature is of paramount importance to any research endeavor, as it not only gives an idea on the work done in the past and assists in delineation of problem area but also helps to conceptualize the related factors to be taken up for the study. An attempt has been made to review the relevant literature which had meaningful relation to the study are presented under the following heads.

2.1 Profile characteristics of the onion growers
2.2 Awareness level of onion growers
2.3 Knowledge level of onion growers
2.4 Adoption behaviour of onion growers
2.5 Constraints in onion production
2.6 Suggestions for improvement of onion production

2.1 Profile characteristics of the onion growers

2.1.1. Age

Phadatare (1999) revealed that the majority (60.66 percent) of the onion growers belonged to the middle age group i.e. between 41 to 55 years.

Naika and Nagabhusanam (1997) reported that 74.42 per cent of dryland farmers were old aged.
Beulah Sara Sahaya Mary. K (2004) study found that among the medicinal plant growers young and middle aged growers constituted 42.00 percent.

Sundar (2002) study revealed that 40.00 percent of the respondents were in the age group of 36-45 years while 36.00 percent fell in the age group of 46-55 years. Young farmers (Upto 35 years) constituted 10.00 percent to total number of Gloriosa growing farmers.

Deepa Barathi Barathi (2003) observed that majority of the senna growers (64.17%) were found in the middle aged group followed by 22-50 percent in the old age group and 13.33 percent in the middle age group.

Parkavi (2003) observed that 51.66 percent of cardamom planters falling under middle aged category followed by 26.68 percent under old age and 21.66 percent under young age.

Manju (2004) reported that the age group between 40 and 49 were showing much interest in cultivating Ashwagandha and Coleus which were accounted for 47.62 and 44.55 percent followed by the age group of 50-59 (23.81%) and the least 7.41 percent was found in the age group of above 60 years of age.

Jayashree (2004) reported that nearly half (45.83%) of the respondents belonged to old age group followed by 41.67 percent in middle age group and 12.50 percent in the young age group.

Vilas (2005) found that 52.50 percent of the farmers belonged to middle age group followed by 31.67 percent in old age group and 15.84 percent in the young age group.

Floralavanya (2007) indicated that exactly half (50.00%) of adopters old age category, which has higher than the non-adopters (26.60%) of drip irrigation.

There were 41.70 percent of adopters who belonged to middle category whereas 63.40% percent of non-adopters belonged to the same category. 5.00% percent of adopters belonged to young age categories that were less than the non-adopters (10.00%).
Parthiparaja (2007) reported that exactly three-fifth (60.00%) of the Jasmine growers belonged to old age category followed by 32.00 percent and 82.00 percent under middle and young aged categories respectively.

Sudha (2008) found that 52.50 percent of the respondents were found in the old age category followed by 33.30 percent in middle age category and only 14.20 percent in young age category.

Sendil kumar (2009) revealed that nearly three-fifth (57.00%) of the paddy farmers belonged to middle age category followed by 31.00 percent in old age and 12.00 percent in the age category.

Anbarasan (2010) observed that middle age people were 38 in numbers (42.20%) followed by young age people were 29 in numbers (32.30%) and old age people were 23 in number (25.60%).

Balasubramaniyam (2010) inferred that 51.70 percent of the respondents were composed of young respondents followed by 40.00 percent of respondents belonged to the middle age group and only 8.30 percent of respondents belonged to old age groups.

Manimekalai (2011) revealed that exactly two-fifth (40.00%) of the respondents belonged to middle age category followed by old (30.66%) and young (29.34%) age categories. It was obvious that a little more than three-fourth (70.66%) of the respondents were middle to old aged.

Sankari (2012) noticed that nearly half (48.33%) of the respondents were from middle and old age (46.67%) groups followed by young age group (5.00%).

Shivaji Chandrakant Waykar (2013), study was observed that more than half (61.82%) of the onion growers belonged to middle age group, 21.82 percent and 16.36 percent of onion growers belonged to young and old age group respectively.

### 2.1.2 Socio-economic status

Phadatare (1999) revealed that majority (66.10 percent) of the onion growers belonged to the medium level of socio-economic status.
Sakthivel (2000) observed that majority of the tapioca growers had medium level of socio economic status 63.33 percent and 44.17 percent of the farmers had low level of socio-economic status respectively.

Dudhe (2002) reported that 38.67 percent of the farmers had medium level of socio-economic status followed by 30 percent with lower socio-economic status.

Deepa Barathi (2003) inferred that 39.17 percent of the respondents had low level of socio economic status followed by medium (30.00%) and high levels (25.83%) of socio economic status.

Jayalakshmi (2004) concluded that nearly 45.00 percent of the respondents had medium level of socio economic status followed by 34.15 percent had low and 2.44 percent had high level of socio economic status.

Jismy Jose (2006) reported that 50.83 percent of the respondents had high level of socio economic status followed by 46.60 percent had medium level and only 31.73 percent had low level of socio economic status.

2.1.3 Educational status

Ogunfiditimi (1981) found that education of the farmers had positive and significant relationship with adoption of improved farm practices.

Pandey and Bisaria (1998) reported that education was considered to be an effort to protect, conserve and develop the vital natural forest resources for the rational utilization of important medicinal plants.

According to Arunkumar (2002) the functionally literates dominated (53.00%) the educational status among the cassava growers.

Sundar (2002) revealed that about 15-18 percent of medicinal growers were illiterates while 37.00 were educated up to higher secondary level and 46.00 percent were educated up to primary level. Farmers with middle school level education constituted 21.00 percent.

Boban (2002) in his study on “adaptation behavior of vegetable growers in crisis situations” observed that more than half (52.00%) of the respondents had high school level of education and 39.33 percent had primary level of education. The rest (8.67%) of the respondents were just literates.
Battle et. al. (2003) interpreted that majority of the farmers had a high school degree; 13 percent had less than a high school education, and 37 percent had some college education or a college degree (9.6%) had postgraduate education or degree.

Koli (2003) observed that two-fifth (40 percent) of the onion growers had completed primary level of education (upto 4th Std)

Wankhede (2004) revealed that 50 percent of respondents had undergone formal education i.e. primary education followed by 25.33 percent of the respondents had secondary education and only 14 percent of the respondents had high level of education.

Manju (2004) found that more than half (52.00%) of Ashwagandha and Coleus growers were educated up to primary level.

Jeyaseelan (2005) revealed that around 30.00 percent of the respondents were middle school educated followed by primary educational level (29.33%) and functionally literate (16.00%). A negligible portion (14.67%) was in secondary school of education and illiterate (8.00%) level among the medicinal plant growers.

Saravanapriya (2005) reported that 88.00 percent of the vegetable growers were in the category ranging from primary to collegiate education and meagre percentage of the respondents fell under the functionally literate category 11.68 percent there were no illiterates.

Rajeskanna (2006) revealed that most (93.00%) of the respondents of Dharmapuri district had education of middle school and upwards. In Krishnagiri district more than three-fourth (77.00%) of the respondents had middle school level of education and upwards

Sathiya Chitradevi (2006) revealed that more than 90.00 percent of the farmers were found literates. Illiteracy percentage was found minimum (5.00%) whereas only about 39.00 percent of the respondents were under high school to collegiate level of education.
Shanmugha Chithra (2007) reported that one third 36.25 percent of them had middle school level of education, followed by primary education, only 16.25 percent had possessed secondary and higher secondary level of education whereas only about 10.00 percent of the respondents had collegiate level of education.

Persis (2007) found that 40.80 percent of tribal farmers were illiterate above one-fifth (26.00%) of them had primary level of education. 20.70 percent had middle level education 8.30 percent had high school. 2.50 percent had higher education and only 1.70 percent of them had collegiate education.

Shivaji Chandrakant Waykar (2013), study found that nearly half the onion growers (47.27%) had completed primary education, 18.20 percent of them had completed secondary education, whereas 13.63 percent of them were illiterate. However 10 percent of them had completed collegiate education.

2.1.4 Occupational status

Singh, A.K et al (1998) stated that cultivation and processing of material harvested from medicinal plants could provide much needed avenues of self-employment to the educate unemployed youths in villages and small towns.

Maiti (2000) stated that 95.00 percent collection of medicinal plants was from the wild, generating about 40 million man-days of employment. Conservation and sustainable use of medicinal plants were essential for generating productive employment for the poor.

Deepa Barathi Barathi (2003) observed that more than half of the senna growers (54.16%) were engaged in farming as their main occupation.

In the study entitled, “Cultivation of medicinal plant for the benefit of marginal women farmers in Bhima Catments’s Area”, Tetali et. al. (2002) found that farming was the main occupation to the Mahadeo Koli tribal community living in that area.
Thilakarathne and Imai (1998) reported that in the traditional area, 94 percent of working family members depended on agriculture as their main occupation as against 73 percent in the newly settled area and 83 percent in the old settled area.

Ramasubramanian (2003) reported that 54.00 percent of the dryland farmers were in farming + wage earning occupation followed by farming alone (27.00%) as occupation. Lesser proportion of respondents were found to engage in farming and business (13.00%) and farming and services (6.00%).

Sukitha (2003) concluded that farming was the major occupation for 54.17 percent of the grape growers. 33.33 percent of them had business along with farming and 10.83 percent were engaged in services in addition to farming.

Saravanan (2003) discussed that more than half (55.43%) of maize growers had farming and wage earning whereas a little more than one-fifth (10.84%) of the maize growers had farming and business as their main occupation and 4.814 percent had farming and services as their main occupation.

Balasubramani et. al. (2004) reported that majority (86.67 percent) of the respondents had agriculture as primary occupation.

Nalini (2004) pointed that nearly one-third (31.67%) of the respondents had farming alone as their profession followed by farming + wage earners (26.07%). While 15.00 percent of the respondents were wage earners around one-tenth (10.83% and 9.16%) of the respondents were occupation as farming + service and farming + business respectively. Only a very meagre proportion of the respondents were service (4.17%) and business (2.50%) as their occupation.

Ramya (2005) proclaimed that majority (82.22%) of the respondents had agriculture as their main occupation and the rest (17.78%) of the respondents practiced agriculture as subsidiary one.

Thangaraja (2008) proposed that more than three-fourth (77.78%) of the precision farming beneficiaries practicing agriculture as their main occupation followed by 22.22 percent precision farming beneficiaries practiced agriculture as main in combination with other occupation as subsidiary.
Kavaskar (2009) reported that a little more than three-fifth (60.83%) of the respondents had farming as their sole occupation.

2.1.5 Farming experience

Nagabushanam (1997) noticed that as high as 48.89 percent had medium level of farming experience followed by high level of experience 30.56 percent and 20.55 percent had low level of farming experience.

Prabhakar (2000) found that majority of medicinal plant cultivators had low level of farming experience.

Sundar (2002) observed that 54.00 percent of farmers had 26-35 years of experience in farming while about 20.00 percent in group I and 25.00 percent in group II had 16-25 years of experience in the cultivation of Gloriosa.

Deepa Barathi Barathi (2003) revealed that 42.50 percent of respondents had low level of experience in Senna cultivation followed by medium 39.17 percent and high 18.33 percent levels. Further, she added that Senna cultivated as a medicinal crop amongst the farming community.

Beulah Sara Sahaya Mary (2004) revealed that exactly two–fifth (40.00%) of the respondents had medium level of experience in farming which ranged from 24 to 30 years. This was followed by low level 37.14 percent and high level 22.68 percent. The low level experience ranged below 24 years as per cumulative frequency value.

Jeyaseelan (2005) found that more than two-third (38.66%) of them had low experience in medicinal plan cultivation followed by an equal proportion (30.67%) of medium and high level categories.

Jismy Jose (2006) observed that there was almost equal level of farming experience in low medium and high level in the 36.00 percent. 30.67 percent and 33.33 percent respectively.

Elakkia (2007) reported that more than two-third (69.17%) of the respondents had more than ten years followed by nearly one third (30.00%) with five to ten years of farming experience. Only 0.83 percent of respondents had less than five years of farming experience.
Thiyagarajan (2011) stated that nearly half (46.70%) of the SRI farmers had medium level of farming experience followed by 30.80 percent with low level of farming experience and the remaining 22.50 percent of the SRI farmers had high level of farming experience.

Bagishkumar (2011) reported that nearly two-third (65.00%) of the respondents had two to ten years of experience in potato cultivation followed by less than two years (20.83%) and more than ten years (14.16%). (Bagishkumar. 2011. A study on accessibility and utilization behavior of potato growers on cold storage facilities.

2.1.6 Farm size

Savithiri (1992) found that farm size showed no significant relationship with knowledge level.

Kamaraj (1996) stated that farm size had significant and positive relationship with knowledge level of dry land farmers.

Muni Ram *et. al.* (1999) stated that the cultivable area of poppy has been reducing continuously.

Phadatara (1999) concluded that substantial medium size of land holding upto 2.00 to 4 ha was found among 50.80 percent of onion growers.

Prabhakar (2000) stated that most of the farmers were under the low category in terms of area under medicinal plant cultivation.

Tamilselvan (2000) stated that for meeting the growing demand of various medicinal plants, the area under cultivation has to be increased and farmers have to be encouraged to take up cultivation systematically.

Bhuse and Ghule (2002) observed that in India, majority of the medicinal growers were with marginal holding with less than 2.50 hectare land.

Ponnuswami and Muthuswamy (2002) reported that the available statistics on area under cultivation of Senna was around 6000 hectare located in various regions.
Deepa Barathi Barathi (2003) revealed that 54.16 percent of Senna growers were found to operate medium level of farm holding followed by 29.17 percent as big farmers. The rest were found distributed among small 12.50 percent and marginal 4.17 percent farmers.

Koli (2003) found that more than 55.83 percent of onion growers had medium size of land holding (2.00 to 4.00 ha).

Beulah Sara Sahaya Mary (2004) reported that exactly three-fifth (60.00%) of the medicinal plant growers were found to be marginal followed by small (28.88%) medium (8.89%) and big (2.23%) farmers.

Mane (2005) revealed that 79.50 percent of the onion growers had medium size of land holding (2.00 to 6.00), while 14.50 percent of the onion growers had Large size of land holding (above 6.01 ha)

Maghade (2007) revealed that 43.44 percent of the onion growers had medium size of land holding (2.01 to 4.00 ha) whereas, 34.56 percent of growers had small size of land holding (less than 2 ha) and 22.00 percent of the growers had large size of land holding (above 4.01 ha)

**2.1.7 Area under onion cultivation**

Gopalkrishnan (1994) observed that most of the farmers possessed small size holdings (42.50%) followed by marginal land holding (28.33%) and medium land holding (15.83%).

Prabhakar (2000) indicated that majority (83.33%) of the farmers were under the low category in terms of area under medicinal plants followed by high category (16.67%) category and none was found under the medium category.

Vajaiyalan (2001) study revealed that nearly half (46.06%) of the rice growers had a small size area under rice cultivation whereas more than one third (35.84%) of them had medium size area under rice cultivation. Only less than one-fifth (17.50%) of the rice growers had larger area under rice cultivation.
Manju (2004) reported that the area under Ashwagandha and Coleus for individual respondent was 0.82% hectare and 0.94 respectively. Which was accounted for 35.96 and 36.19 percent to the total land use prevailing among the respondents.

Jeyaseelan (2005) revealed that majority (76.00%) of the growers apportioned their land for medicinal plant cultivation followed by medium (19.00%) and low (5.33%) levels of category.

Andhar viriresh vilas (2005) concluded that majority of the respondents (56.66%) allocated more than 65.00 percent of their total farm holding for paddy cultivation followed by medium (33.34%) and small farm size (10.00%) holding respectively.

Mankai (2005) suggested that nearly half (48.00%) of the vegetable growers had high level of area under vegetable cultivation.

Jaisridhar (2009) stated that 58.89 percent of the maize growers had maize area upto 5 acres followed by 30.00 percent with 5-10 acres and only 11.11 percent of the maize growers had more than 10 acres.

Anamica (2010) concluded that 56.67 percent of the respondents were holding dry farming area of less than 2.5 acres and remaining 43.37 percent with 2.5 to 5 acres.

Karpagam (2012) stated that majority (86.67%) of the respondents had turmeric area upto 5 acres followed by 12.50 percent with 5-10 acres and only 0.83 percent of the turmeric growers had more than 10 acres.

Shivaji Chandrakant Waykar (2013), study indicated that more than half (51.33 %) of the onion growers had 0.40 ha to 1 ha area under onion crop while 44.67 percent of them had 1ha to 2 ha area under onion crop.

2.1. 9 Experience in onion cultivation

Illayaraja (2001) found that more than fifty percent of the grape growers (52.50%) had medium level of experience in grape cultivation followed by high (27.50%) and low (20.00%) levels respectively.
Sorensen *et al.* (2002) revealed that 15 percent of the Minnesota farmers had used precision farming for 1-2 years, 44 percent for 3-4 years and 41 percent for 5 years or more.

Suganthi (2004) reported that more than half of the cashew growers (54.00%) possessed a high level of farming experience in cashew cultivation, followed by medium (23.00%) and low (23.00%) levels of experience in cashew cultivation.

Ganesamoorthy (2005) study found that 70.00 percent of the turmeric growers had medium level of experience in turmeric cultivation followed by low (18.34%) and high (11.67%) levels.

Mankai (2005) inferred that majority of the respondents had high level of farming experience (91.00%) in vegetable cultivation.

Sudha (2008) reported that 52.50 percent of the respondents had medium level of experience in precision farming followed by 20.00 percent had low and 27.50 percent had high level of experience in precision farming.

Jayanthi (2013) reported that nearly seventy (67.50%) percent of the respondents had medium level of experience in maize cultivation followed by 16.67 percent and 15.83 percent at high and low levels respectively.

Maheshkumar (2013) revealed that 43.34 percent of the banana growers had medium level of experience in banana cultivation which ranged from 11 to 20 years. This was followed by low (30.83%) and high level (25.83%) levels respectively.

2.1.10 Annual income

Phadatare (1999) revealed that, majority of the onion growers (65 percent) were earning Rs. 60,000 to 90,000 per annum which falls in the category of medium annual income.

Prabhakar (2000) stated that most of the medicinal plant growers were found distributed between low and middle level of annual income.
Sasidharan (2000) stated that traditionally the tribes and local communities living in and around the forest areas were engaged in the collection and sale of minor forest produce and possessed low level of annual income.

Srivastava et.al. (2000) proposed that Resemarinus Officinalis, Salvia Offinalis may be brought under local agricultural practices. This will not only add to income of marginal farmers but also development in rural areas.

Bhaskar Rao and Jeyakumar (2001) had found that cultivation of lemon grass in about 25 acres will generate income on daily basis like that of dairy industry.

Nautiya et.al. (2001) found that products under medicinal plant cultivation and from species collected in the wild accounted for 3.67 and 6.45 percent of the total income respectively of an average household.

Subramaniyan and Ganjana (2001) found that lemon grass growers could get net returns of Rs. 14,812 per hectare.

Korikanthinath et.al. (2002) found that for ten crop seasons an average of 662.72 kilo/ hectare. (Dry) cardamom capsules were obtained which is almost five times more than national average yielding of 140 kilo/ hectare. A net income of Rs. 109147.53 per hectare (average of ten crop seasons) was obtained with the production of Rs. 60.92 per kilo (Dry).

Ajjan et.al. (2002) found that in the case of small farmers the cost cultivation of Senna crop is Rs. 4417.35 per hectare as against the net returns of Rs. 13315.54 per hectare. Further, they also reported that cost of cultivation of Periwinkle crop is Rs. 5405 per hectare and the economic net return is Rs. 28330.81 per hectare.

Deepa Barathi Bharathi (2003) revealed that most of the respondents (83.33%) belonged to high income category followed by medium (10.00%) and low (6.67%) categories.

Maghade (2007) revealed that, 82.50 percent of onion growers had medium annual income between 54,667 to 1,55,086, followed by 11.66 percent of them were in high income group, whereas, only 5.83 percent of them had low income group.
2.1.11 Contact with extension agency

Senthil vadivoo (2003) stated that nearly half (48.33%) of the respondents had medium level of extension agency contact followed by 26.67 percent in the low level.

Suganthi (2004) found that 35.00 percent of the cashew growers had medium level of extension agencies contact followed by 33.00 percent and low 32.00 percent levels of extension agency contact. Thus, more than one-third (35.00%) of the cashew growers had medium level of extension agency contact. This was reasoned by her that big farmers of the study area had contacts with regional research station, Virudhachalam and State Department of Horticulture.

Vilas (2005) elucidated that nearly half (48.34%) of respondents had medium level contact with extension agency followed by low (27.50%) and high levels (24.16%).

Elakkia (2007) reported that nearly two-third (63.34%) of the respondents had high level of extension agency contact followed by low 26.66 percent and medium 10.00 percent level of contact.

Thangaraja (2008) reported that reveals that exactly two-third (66.67%) of the precision farmers had medium level of contact with extension agency, 17.78 percent had high level of contact, while the rest (15.56%) of the farmers had low level of contact with extension agency.

Sangeetha (2009) revealed that 83.64 percent of the farmers had medium to high level of extension agency contact followed by 16.36 percent with low level of extension agency contact.

Anbarasan (2010) revealed 91.66 percent of farmers had low level of contact with extension agencies followed by 8.33 percent of the farmers had medium level of contact with extension agencies and no farmers having high level of contact with extension agencies. From the finding it could be concluded that low level of agency contact predominant with farmers frequently visit of agricultural officers and private farm consultant have enabled the farmers to establish to contact with extension personal before the e-velanmai scheme implementation.
Manimekalai (2011) concluded that nearly half (46.66%) of the farmers had medium level of extension agency contact followed by 28.00 percent with high level of extension agency contact and 25.34 percent with low level of extension agency contact.

2.1.12 Farm power possession

Ponnusamy (1993) revealed that 50.00 percent of the respondents had low level of farm power status followed by 36.67 percent with medium level and 13.33 percent had low level of farm power status.

Rani (1998), Mary (2001) and Cinthia (2002) reported a similar finding of majority of respondents were in the medium farm power status. Palmurugan (2002) and Shibi (2002) contradicted the above researchers as they found majority were in the low level of farm power status.

Kavitha (1999) study revealed that more than half of the drip users (51.66%) had high farm power status followed by 33.34 percent had medium and 15.00 percent had low farm power status.

Arunkumar (2002) study shows that majority (64.11%) of the commercial cassava cultivators had medium level of farm power possession followed by 22.50 had high and 13.33 percent of the respondents had low level of farm power possession.

2.1.13 Social participation

Vennila (1998) indicated that 39.00 per cent of respondents had medium level of social participation followed by high (36.00%) and low (25.00%)

Phadatare (1999) pointed out that half percentage of onion growers had medium level of social participation.

Mary (2001) observed that one-third (35.83%) of respondents had medium level social participation and two-third (64.00%) had low level social participation.

Shibi (2002) revealed that majority (76.70%) had medium level social participation followed by high (23.30%).
Pravin Lalaso Jadhav (2009), study was observed that 46.92 percent of the onion growers had medium level of social participation followed by 33.84 had low and 19.24 percent had high level of social participation.

**2.1.14 Mass media exposure**

Shantha shella (1999) found that 17.00 percent of the respondents had low level of mass media exposure followed by medium 63.00 percent and high levels 20.00 percent of mass media exposure.

Saravanakumar (2000) in his study on “Impact on TANWA in the empowerment of farm women” observed that 81.70 percent had medium level of mass media exposure followed by high (16.90%) and low (1.40%) mass media exposure.

Johnson (2002) study revealed that more than one-third (36.67%) of the respondents had medium level of mass media exposure in cashew cultivation followed by low (33.33%) and high (30.00%) had mass media exposure in cashew cultivation.

Senthil vadivoo (2003) study revealed that exactly half (50.00%) of the respondents had low level of exposure to mass media sources.

Mankai (2005) stated that (38.00%) of the vegetable growers had high level of mass media exposure followed by 32.00 percent had medium and 30.00 percent had low mass media exposure.

Sathiya chitradevi (2006) found that more than two-fifth (44.17%) of the respondents had medium level of mass media exposure followed by high (33.33%) and low (22.50%) levels of mass media exposure.

Thangaraja (2008) study revealed that more than half (53.33%) of the respondents had media level of mass media exposure followed by one-fifth (25.56%) and 21.11 percent had high level of mass media exposure.

Anbarasan (2010) noticed that 91.10 percent of the respondents used television, 80.00 percent of respondents used news paper, 73.30 percent used radio, 31.10 percent used magazine, 21.10 percent used bulletins and 11.10 percent used computer and Internet with a same proportion of respondents.
2.1.15 Information seeking behaviour

Ponnusamy (1993) found that the sources of information like posters, hoardings, newspapers, and radio, television and agriculture literatures were known to 91.67 per cent, 85.83 per cent, 66.67 per cent, 58.33 per cent, 49.17 per cent and 43.30 per cent of the farmers.

Dulle and Aina (1999) investigated the information needs of small scale dairy farmers in Tanzania and reported that they were found to be in need of information on livestock feeds availability and feeding techniques (97.20%), parasite and disease control (83.10%), general animal husbandry (81.70%), heat detection and breeding techniques (43.70%) and information on milk marketing (39.40%). In resolving their information needs it was found that attending extension meetings and extension worker visits were the most dependable information sources used by the majority of farmers. The use of agricultural libraries as an information source was very uncommon to the majority of the respondents with the major reason being lack of such a service.

Ramasubramanian (2000) found that Field Demonstration Officer and Assistant Agricultural Officer were the major institutional sources used by respondents. Friends (93.33%), relatives (90.00%) and input dealers (80.00%) were their major non institutional sources. With respect to the media sources radio, television and newspaper were the most utilized sources for respondents.

Deepa Barathi (2003) study revealed that nearly two-third (63.33%) of the respondents sought information through media like radio and television, 31.57 percent received information through officers of State department of agriculture like Agricultural Officers, Assistant Agricultural Officers.

Persis (2007) viewed that more than three-fourth (76.70%) of the tribal farmers had medium level of information seeking behavior.

2.1.16 Risk orientation

Rajkumar (1992) observed that 63.33 percent of medicinal plant growers possessed medium risk orientation 24.20 percent possessed high risk orientation and 12.50 percent had low risk orientation.
Jeyasubramanian (1996) reported that 23.80 percent of medicinal plant growers had low level of risk preference.

Prabhakar (2000) reported that most of the medicinal plant growers were under the category of medium level of risk preference.

Mary (2001) have found that majority of the respondents fell in the category of medium to low risk orientation.

Arunkumar (2002) reported that majority of respondents were in high category of risk orientation followed by medium category.

Deepa Barathi Barathi (2003) reported that majority of the senna growers (63.33%) had medium level of risk orientation followed by high (23.34%) and low (15.83%).

Hema (2003) stated that nearly half (48.33%) of the respondents possessed high level of risk orientation. There existed low and medium level of risk orientation with 26.67 percent and 25.00 percent respectively.

Senthil vadivoo (2003) observed that 43.33 percent of the respondents had medium level of risk bearing nature followed by low (31.67%) and high (25.00%) levels.

Beulah Sara Sahaya Mary (2004) observed that vast majority of medicinal plant growers had medium level (58.89%) of risk orientation followed by high (30.00%) and low (11.11%) levels.

Santhi (2006) revealed that exactly three-fourth (75.00%) of the respondents had medium level of risk orientation followed by 22.00 percent of the respondents under low level. Only 3.00 percent of the respondents belonged to high level of risk orientation.

Thangaraja (2008) study revealed that 41.15 percent of dryland farmers had high level of risk orientation followed by 37.75 percent and 21.10 percent had medium and low levels of risk orientation respectively.
Vengalamani (2009) revealed that 41.70 percent of the respondents had high level of risk orientation followed by medium (36.60%) and low (21.70%) levels of risk orientation.

Pravin Lalaso Jadhav (2009), study revealed that more than half (50.76%) of the onion growers belonged to medium risk orientation category followed by 26.92 percent of them had low and 22.32 percent of them had high level of risk orientation.

Anamica (2010) inferred that the risk orientation level is generally high among the respondents (42.33%0 followed by moderate (31.11%) and low levels (26.67%).

Lavanya (2010) indicated that more than one-third (39.00%) of the respondents had got moderate level of risk orientation. Further comparison revealed that more big farmers were seen to have got moderate risk orientation (44.00%) than small farmers (34.00%). Access to capital, operation of large size farms and high withstanding ability would have helped to posses more risk bearing behavior. The ‘t’ value also confirmed the significant differences existed among the two categories of farmers.

Kavitha (2011) noticed that 35.00 percent of the respondents had high level of risk orientation followed by moderate (33.34%) and low levels (31.66%).

Thiyagarajan (2011) stated that, a little more than two-fifth (43.30) of the System of Rice Intensification farmers had high level of risk orientation behavior followed by 42.50 percent of the System of Rice Intensification farmers with medium level of risk orientation behavior and rest (14.20%) of the System of Rice Intensification farmers had low level of risk orientation behavior.

2.1.17. Innovativeness

Prabhakar (2000) reported that most of the farmers growing medicinal crops were innovative in nature

Arya (2001) observed that few of the qualified farmers of Jhuni and Khaljhuni villages in Bageshwar district of Uttar Pradesh took the initiate to cultivate new species of medicinal plants in their field.
Banumathi (2003) explained that exactly three-fourth (75.00%) of the respondents had a high level of innovativeness followed by medium (18.33%) and low (29.16%) level of innovativeness.

Deepa Barathi (2003) in her study noted that 38.00 percent of the vegetable growers had high level of innovativeness followed by medium (31.00%) and low (31.00%) level of innovativeness.

Senthil vadivoo (2003) reviewed that 40.00 percent of respondents had high level of innovativeness followed by low (35.00%) and medium (25.00%) levels.

Jayashree (2004) observed that nearly half of the respondents (47.50%) were found medium level of innovativeness. Low and high levels were found with 29.17 percent and 23.33 percent of the respondents respectively.

Suganthi (2004) in her study recorded that exactly three-four (75.00%) of the cashew growers had high level of innovativeness and the rest (25.00%) of the cashew growers had medium level of innovativeness.

Desingurajan (2005) revealed that 37.50 percent of the respondents had high level of innovativeness followed by medium (35.83%) and low (26.67%) levels.

Vilas (2005) noted that two-fifth (40.00%) of respondents were found to have low level of innovativeness. Medium and high levels were found with 35.83 percent and 24.17 percent of the respondents respectively.

Jeyaseelan (2005) revealed that the meditational plant growers nearly two-third(65.33%) of them preferred and took their own time to adopt the recommended farm technologies and (28.00%) fell under medium and adopted technologies after seeing the success of the technologies and only (6.66%) of the medicinal plant growers adopted technologies as soon as brought to their knowledge.

Floralavanya (2007) observed that most of the adopters possessed high level of innovativeness followed by medium (26.70%) and low level (15.00%) of innovativeness which entirely differs from that of non-adopters who possessed 51.42 percent of innovativeness under low level followed by 28.23 percent under middle and 20.35 percent under high level of innovativeness.
Sathiyabama (2008) observed that 52.00 percent of the respondents had high level of innovativeness followed by medium (32.00%) level of innovativeness. Only 16.00 percent respondents had low level of innovativeness.

2.1.18 Credit orientation

Chauhan et al. (2000) revealed that 70.00 per cent of farmers had no credit, however 30.00 per cent of farmers had a credit of varying range, 3.00 percent respondents had a credit upto Rs.1000/-, 16.00 per cent upto Rs.5000/- and 11.00 per cent had above Rs.5000/-. It was observed that majority of farmers had taken loan for agricultural purpose which is a good indication of agricultural enterprise; however, it can be inferred that credit orientation among the farmers was very less.

Singh and Rawat (2001) studied the impact of farm credit on agriculture in Deoria district of Eastern Uttar Pradesh and observed that maximum crop loan, livestock loan and pumpset / tube well loan was disbursed by cooperative societies, regional rural banks and commercial banks, respectively.

The highest crop and livestock loan was accorded by the smallest group of farms. All costs are higher on borrower farms than non-borrowers farms because borrower farms were using more input factors as compared to non-borrower farms. Returns were higher on borrower farms than non-borrower farms.

2.1.20 Communication status

The research findings of Nagabhusanam (1997), Renganathan (2001) and Bhuvaneshwari, V.B (2002) indicated that majority (70.00-80.00%) of respondents fell in the category of medium to low communication status.

Shibi (2002) found that majority (73.26%) of respondents were in low category followed by high (16.75%) and medium (10.00%) categories.

2.1.21 Scientific orientation

Sophia (1991), Kamaraj (1996) and Renganathan (2001) found that majority of respondents fell in the category of medium to low scientific orientation
Arunkumar (2002) and Palmurugan (2002) reported a similar finding of majority of respondents were in the category of very high scientific orientation (82.00 and 93.20%).

Anuraj (2003) study revealed that 41.00 percent of the respondents had high level of scientific orientation followed by low level (32.00%) and medium (27.00%) levels of scientific orientation.

Suganith (2004) quoted that 45.00 percent of the cashew growers had high level of scientific orientation followed by medium (33.00%) and low (22.00%) level of scientific orientation.

Desingurajan (2005) studied that the orientation towards risk preference and technical aspects in Coleus cultivation was found to be nearly equally distributed between the medium (43.33%) and high (39.17%) followed by low level.

Ramy (2005) conducted a study on marketing behavior of curry leaf reported that more than half (53.33%) of the respondents had medium level of scientific orientation, followed by 27.78 percent with high level and the rest (18.89%) with low level.

Anithamary (2006) expounded that nearly half (47.50%) of organic farmers had high level of scientific orientation followed by medium level (42.00%) of inorganic farmers also had high level of scientific orientation.

Parthasarathi (2007) speculated that little more than one-third (37.50%) of the Bt cotton growers possessed medium level of scientific orientation followed by low (32.50%) and (30.00%) high levels of scientific orientation.

Arularasi (2009) elicited that nearly two-third (64.44%) of organic banna growers had medium level of scientific orientation followed by equal percent (33.33%) of banna growers with high and low level of scientific orientation. With regard to inorganic banna growers 75.55 percent had medium level of scientific orientation followed by (17.78%) and low (6.67%) level.

Anbarasan (2010) stated that exactly two-third (66.67%) of the respondents had medium level of scientific orientation followed by low (20.00%) and (13.30%) levels of scientific orientation.
Kavitha (2011) elicited that nearly half (45.00%) of the respondents possessed a moderate level of scientific orientation followed by 35.00 percent with high and 20.00 percent with low level of scientific orientation.

Thiyagarajan (2011) noticed that more than 45.00 percent of SRI farmers possessed high level of scientific orientation behavior followed by 33.30 percent medium level and 20.80 percent with low level of scientific orientation behavior.

Karpagam (2012) indicated that nearly three-fifth (59.17%) of the respondents possessed medium level of scientific orientation followed by low (24.16%) and high (16.67%). The farmers better education would have contributed to the present trend in their scientific orientation.

2.1.22 Economic motivation

Deepa Barathi (2003) noted that nearly two-third (63.33%) of the respondents were with medium level of economic motivation followed by high (20.00%) and low level (16.67%) of economic motivation.

Jayalakshmi (2004) revealed that 36.70 percent of the respondents had high economic motivation followed by (35.00%0 and (28.30%) who had medium and low level of economic motivation.

Mankai (2005) inferred that little more than one-third (37.00%) of the vegetable growers had high level of economic motivation.

Archana (2007) indicated that only 15.00 percent of the respondents belonged to low level of economic motivation while others belonged medium to high level of economic motivation.

Thangaraja (2008) reported that more than two-fifth (42.22%) of the precision farmers had medium level of economic motivation followed by high (32.22%) and low economic motivation.

Sendilkumar (2009) inferred that nearly half (47.00%) of the respondents had medium level of economic motivation followed by (37.00%) who had low level of economic motivation. Only (18.00%) of the respondents had a high level of economic motivation.
Anamica (2010) observed that majority (80.00%) of the respondents were having moderate to high level if economic motivation followed by one-fifth (20.00%) of the respondents with low economic motivation level.

Thiyagarajan (2011) indicated that more than two-fifth (41.70%) of the SRI farmers had medium level of economic motivation behavior 36.60 percent of the SRI farmers had high level of economic motivation behavior and the remaining 21.70 percent of them had low level of economic motivation behavior.

2.1.23. Marketing behaviour:

Waman (1993) revealed that 78 percent of the onion growers marketed their produce through commission agents.

Sadaphal (2000) inferred that most of the white onion growers relied upon the wholesaler from their own or neighbouring village for marketing of the white onion produced in their field.

Sonawane et. al. (2002) revealed that 92.91 percent of respondents engaged in nursery management were selling the grafts to wholesaler in the village on their own while, the retail selling of produce from nursery was done by 84.62 percent of the respondent themselves.

Koli (2003) study was observed that more than half of the onion growers (55%) had sold their produce through commission agents 20.83 and 19.17 percent of them sold their produce to wholesalers and retailers respectively. Half of the onion growers (50.84%) had transported their produce to the marketing place by tractor while 23.33 percent had 15.84 percent of them used bullock cart and truck for transporting and 60 percent of the onion growers had done grading at the time of harvesting while 30.83 and 9.17 percent of the onion growers had done grading at the time of storage and marketing respectively. Majority of the onion growers (65 %) had considered the size of the bulbs for grading while 25 percent and 10 percent considered colour and weight of the bulbs for grading.

Maghade (2007) observed that 38.33 percent of respondent onion growers sold their produce in local market, while 8.33 percent of them sold their produce in the district market and 26.67 percent of them sold in pune market.
2.2. Awareness level of onion growers

Shanmuga sundaram (1987) found that 16.68 percent of farmers were aware of the integrated pest management practices recommended for crops and also found that 98.33 percent of the farmers were aware of the enriched FYM technology.

Hareesha (1994) found that almost equal number of farmers had low and high levels of awareness about the ill effects of agricultural chemicals.

Kirubakaran (1995) revealed that 50.00 percent of drip farmers were aware the fertigation through drip irrigation system.

Venkataramani (1995) observed that an increased awareness among farmers about environmental hazards and other related insect resistance and resurgence problems. This gave a new significance to the efficiency of plant derived products in crop protection.

Kiran (2002) found that large majority of the respondents (75.00%) were unaware of the soil, air water are caused by indiscriminate pesticide usage.

Mahindra and Nerdeep Kaur (2004) reported that 47.50 percent of farm women had medium level of awareness about pesticide residue while 36.67 percent had high level of awareness and 15.83 percent had low level of awareness.

Bhuvaneswari, V.B (2002), in her study stated that the majority of the respondents had low to medium of overall knowledge level on eco friendly technology followed by 46 percent of the respondents had medium level of awareness. However, the adoption rate was low as compared to level of awareness.

Poonam (2006) in study found that all the farmers observed change in weather conditions reduce crop yields in Andra Pradesh. They aware especially groundnut does not support untimely rainfall and yields decrease significantly if rain falls at inappropriate times.

Jebapreetha (2007) observed that the majority of the respondents had high level of awareness (77.50%) and more than one-fifth (22.50%) of the respondents had low level of awareness in environmental issues.
Mitra (2007) agriculture is one sector which is immediately affected by climate change but it is expected that the impact on global agricultural production may be small. However, regional vulnerabilities to food deficits may increase; therefore climate change has a direct impact on food security. Climate change is a global problem and India will also feel the heat, nearly 700 million rural people in India directly depend on climate sensitive agriculture sector.

Parrish (2009) stated that farmers were aware about the disrupted balance of nature due to harmful effects of continued application of chemical pesticides.

Gangadharappa et al (2010) revealed that regardless of literacy, those who are directly linked with the process of pollution are more aware of its hazards. Further it was stated that lack of awareness act as a catalysts of environmental degradation.

Poornima sharma (2010), in her study finds out that there is lack of immense awareness on the science and technology achievements and it can be managed among the farmers through organizing training to the farmers for better onion production.

Simon et al (2013), study was observed about the awareness of sustainable agricultural land management practices among the farmers field crops in northern part Tharaba district, Nigeria. The study findings revealed that there was high level of awareness (95%) of use of sustainable agricultural land management practices among the respondents.

Kiruthika, L. (2013), the study conducted in Perambalur and Trichy districts among the onion growers revealed that the adoption level was less (8.12%) while awareness index was high (12.12%).

Sokoya et al (2014), study revealed that awareness programmes on agricultural practices is key factor in ensuring food security. Information on good knowledge of modern agriculture technology and its usage will enable improved cultivation and also nations all round wealth.

2.3. Knowledge level of onion growers

The knowledge defined as the change in a person cognitive learning behavior resulting from a specific learning experience.
English and English (1958) corroborated that knowledge as a body of understood information possessed by an individual or by a culture and also explained that knowledge is part of a person’s information which is in accordance with established fact.

Jeyasubramaniam (1996) concluded that majority of the participants reported that they had gained adequate knowledge about medicinal plants 85.7 percent and another 45.2 percent expressed they gained confidence to cultivate medicinal plants and earn profit.

Prabhakar (2000) reported that the farmers of Rosemary crop had medium level of knowledge about the cultivation practices. They possessed Knowledge about method of planting, seed rate and its medicinal value. Majority of the farmers of Horseradish found to have low level of knowledge. At the same time thyme growing farmers has medium level of knowledge

Dwivedi and Solaanki (2000) indicated that rural women had very good knowledge regarding usefulness of natural resources particularly agro-forestry and medicinal value of forest plants.

Jain et.al. (2002) concluded that the cultivation of medicinal and herbal plants has not popular in this region due to lack of knowledge about its technologies as well as its markets.

Shrestha and Dhillion (2003) study revealed that local communities possessed knowledge of 113 medicinal remedies derived from 58 species which was used to treat wide range of ailments; despite the socio-cultural transformation, they still possess knowledge of plants and their uses.

Tabuti et.al. (2003) reported that the existence of traditional medicine depended on the related knowledge of their use as herbal medicine, which was important to the herbal medicine trade and pharmaceutical industry.

Koli (2003), study was inferred that majority of onion growers had knowledge about soil type required for onion (100%), preparatory tillage operations like ploughing (100%), seed rate (68.33%), time and age of seedlings at transplanting (76.67%), intercultural operations (90%), proper time of harvesting (95.83%) and after care of the produce (44.17%).
Christy et.al. (2005) study revealed that half of the farm women (48.44%) possessed medium level of knowledge and (15.62%) of them belonged to high level category regarding their knowledge on the utility of medicinal plants in treating the animal diseases.

Varadharajan et.al. (2005) study revealed that women were more knowledgeable than men about household medicines for treatment of fever, care for young ones, lactating animals and poultry.

Vilas (2005) revealed that majority of the respondents (54.16%) had medium level of knowledge followed by high (25.84%) and low (20.00%) levels of knowledge.

Desmuk et.al (2013), in his study revealed that soil type and seed rate were of 100 percent of knowledge level while 57.25 percent had knowledge about plant protection. The adoption level of 84.25 percent and soil type (22.42%), fertilizers application (26.42%) and very meagre 9.43 adopted the practices of irrigating the field after transplanting.

Shivaji Chandrakant Waykar (2013), study was observed that all the onion growers (100%) had knowledge about the selection of varieties having good storage capacity, selection of improved onion seed, use of chemical herbicides and storage of onion in shading.

The practices which were known by majority of onion growers were sowing of onion. In nursery bed size, pest and disease control measures (79.09%), addition use of nitrogenous fertilizers (63.64%), timely irrigation at the time of onion storage (74.54%), cutting of leaves with remaining neck to the onion (70.90%) and grading of onion (72%).

2.3.1 Age and knowledge

Nimje et.al. (1990) reported that age did not show any association with knowledge about ber cultivation practices among farmers.

Sumathi and Annamalai (1993) reported that age possessed non-significant relationship with knowledge levels of both Large and small farm women on rice post harvest technology.
Tharaneethran (1993) observed negative and significant association of age with knowledge level of the beneficiaries of agro forestry programme.

2.3.2 Annual income and knowledge:

Mundhwa and Patel (1987) inferred that, there was a significant association between respondent’s knowledge and their annual income level.

Mehta *et.al.* (1989) explained that, there was significant association between income and farmer’s knowledge level.

Nimje *et.al.* (1990) reported that, income had shown highly significant relationship with the level of knowledge.

Govind *et.al.* (1991) reported a positive and significant relationship between annual income and knowledge level of farm women on farm operations.

Tharaneetharan (1993) observed positive and significant association of annual income with knowledge level of the beneficiaries of agro forestry programmes.

2.3.3 Source of information and knowledge

Veena, Jain and Verma (1987) reported that farmers utilized the information sources positively and significantly with knowledge level.

Waghmare *et.al.* (1988) report confirmed that, farmer’s knowledge increased while they utilized different sources of information

Sophia (1991) found that source of information had highly association with knowledge level of dry land farmers

Savitthiri (1992) found that source of information had positive and significant relationship with the knowledge level of farm women on dry land technologies.

Kamaraj (1996) stated that source of information had significant and positive relationship with knowledge level of dry land farmers.

Sasikala (1997) stated that source of information on dry land technology were found positive and significant association with knowledge level of dry land farmers.
2.3.4. Risk orientation and knowledge

Viju and pillai (1987) stated that, risk orientation significantly and positively related with extent of knowledge about improved agriculture practices.

Sinha et.al. (1988) revealed that, risk preferences significantly have associated with knowledge.

2.3.6. Economic motivation and knowledge

Masood (1987) reported that the knowledge level of the dryland blackgram growers was found positive association with the variable economic motivation.

Sophia (1991) found that economic motivation had highly significant association with knowledge level of dry land farmers.

2.3.7 Knowledge of storage practices

Rasal (1987) observed that MH – 40 when sprayed 15 days before harvest at 2500-4500 parts per million concentrations did not show significant effect on total storage losses of onion.

Currah and Proctor (1990) observed that the lack of space between the floor of structure and onions stored in this manner, air circulation can be restricted so allowing humidity to increase leading to the development of disease together with sprouting and rooting.

Subbarammu et.al. (1990) indicated that to reduce losses of onion in storage structure the crop was harvested at 80 percent leaf fall stage and cured in the field for three days and top of bulbs were cut at 2 cm above neck and shade cured for six days.

Kale et.al. (1992) reported that the total storage losses ranged from 29.25 to 85.85 depending upon the cultivar during six months of storage from June to November. The major causes of storage losses found were physiological loss in weight (34.41 percent), rotting losses (22.6 percent) and sprouting losses (15.80 percent). The highest percentage of rotting losses occurs during May to July when the temperature was high (32 to 34°C).

Musa et.al. (1994) suggested that improved onion storage was possible using traditional straw stores provided the onions were raised on a platform 150 mm above the ground so countering the problems associated with ground moisture and aiding ventilation.
2.4. Adoption behaviour of onion growers

2.4.1 Adoption of improved production technologies

Modernization of agriculture is viewed as a key to social-economic development and in a much broader sense to transform the traditional agriculture into progressive agriculture. Adoption of agricultural innovations can best be considered as a means to achieve increased productivity. Agricultural productivity depends on the extent to which farmers adopt the new technologies are reviewed.

Richardson (1994) inferred that one to one contact and allowed for greater experiential opportunities, which would influence adoption.

Ranganathan (1995) studied the adoption behaviour of rainfed sorghum cultivators in North Western Zone of Tamil Nadu comprising Salem and Dharmapuri districts. He found that cent per cent of respondents were adopting summer ploughing. A lesser per cent (15.00%) of respondents found adopting seed treatment and seed hardening was adopted by negligible per cent of respondents (2.00%). Three-fifth (60.00%) of respondents were adopting Azospirillum application. Application of Farm Yard Manure and top dressing of fertilizer were adopted by a meagre per cent of respondents (5.00% and 6.00% respectively) which was explained by poor economic status of respondents. A similar trend was observed with respect to plant protection measures as minimum number of respondents (10.00%) replied that they adopted the technology.

The findings of Farooq (1997) on adoption of dry farming practices are as follows. All the respondents had adopted the practices like use of drought resistant varieties, use of chemical fertiliser and intercultural operations while majority of the respondents had adopted practices like use of farm yard manure (09.33%), deep ploughing (94.67%), crop rotation (97.33%), mixed cropping (83.33%) and contour cultivation (91.33%). Not much variation could be observed with respect to the percentage of the respondents of various categories (low, medium and high adopters) adopting most of the recommended dry farming practices.
Naika and Nagabhushanam (1997) conducted a study entitled "Extent of adoption of crop technology in Eastern dry zone of Karnataka". They found that majority of the farmers have followed variety, seed rate, application of recommended quantity of farm yard manure and phosphatic fertilizer application in ragi whereas in tomato, the technologies like improved variety, seed rate and spacing were adopted. In case of potato, only improved variety and phosphatic fertilizers were followed. On the other hand to some extent the farmers have adopted nitrogen and potassic fertilizers in the crops.

Das et al. (1999) investigated the level of adoption and factors responsible for the adoption of sorghum production technology among a sample of sorghum growers in Faridabad district, Haryana, India. An adoption index was developed and adoption gap was calculated. Results revealed that 40.00 per cent of respondents had a medium level of adoption gap, while 22.00 per cent had a low adoption gap and 28.00 per cent had a high adoption gap. The highest adoption gap (59%) was observed in the case of plant protection measures, followed by irrigation (51%) and fertilizers (49%). The lowest gap (27%) was recorded in the case of agronomic practices.

Prabhakar (2000) stated that majority of the farmers adopted technologies like method of planting and fertilizer application which was followed by practices like weed and irrigation management practices.

Shiyani et al. (2000) examined the factors influencing the adoption of recently developed improved chickpea varieties in a few remote and backward tribal villages of Gujarat and revealed that the adoption of newly introduced chickpea varieties are gradually increasing in their areas by replacing the prominent local variety.

The duration of crop, farm size, yield risk, and experience of growing chickpea crop are the main factors which influenced the adoption of improved varieties. Based on the analysis it is concluded that the improved varieties with stable yield will act as crop insurance to the farmers who are poor and deprived of insurance coverage.
Sundar (2002) observed that in general selected growers have not adopted technologies recommended by Tamil Nadu Agricultural University with respect to selection of tubers, seed rate and spacing. The practices namely manuring, fertilizer application and plant protection were adopted partially.

Banumathi (2003) observed that an equal distribution of respondents in low and medium levels (40.83%) followed by 18.34 percent in high level adoption category with respect to improved rice cultivation practices.

Koli (2003), study found that majority of the onion growers had adopted the practices like selection of proper soil type (100%), preparatory tillage operations like ploughing (100%), seed rate (63.33%), time and age of seedlings at transplanting (70%), method of planting (75.83%), intercultural operations (84.17%), control measures for onion blight (41.67%), proper method of harvesting (45 %) and curing of the onion produce (38.33%).

Selvamalathi (2003) inferred that more than half of the respondents adopted weed management by hand weeding (78.33%), fertilizers dose (60.00%), and time of application of fertilizer (60.00%) and seed rate (54.17%).

Singh and Bhimawat (2003) revealed that a similar percentage of drip users had medium and high level of adoption (40.00%). Remaining one-fifth of respondents (20.00%) had poor adoption level.

Flora Lavanya (2007) study revealed that sustainable water management through drip irrigation noticed that the intensity of adoption was high with 36.66 percent followed by 33.33 percent under low and 30.01 percent under medium levels.

Sudha (2008) noted that the intensity of adoption was in moderate levels (45.00%) followed by high (18.33%) and low level (36.66%) of adoption.

Devi and Ponnarasi (2008) expressed that adoption of improved technologies emanating from rainfed agriculture research is an important contributor for sustained growth in agriculture and livelihood security of small and marginal farmers.

Tadesse (2008), the study revealed that onion cultivation needs more skills, credit facilities, exposure visits, social participation, quality seeds were significantly influenced the adoption level.
C.P. Amutha and L.B. Hugar (2009), the study indicated that awareness of farmers on different components of market information and its utility was very poor (11 to 37%) as compared to those of trader 75 percent. The researcher suggested to strengthen the dissemination of market information through formal agencies like APMC and KVKs using of ICT services.

Sangeetha (2009) revealed that 81.82 percent of the respondents had medium to higher level of adoption and the remaining respondents had lower level of adoption.

Prabha et al. (2009) study revealed that adoption of agriculture technology had been an important and crucial for raising agricultural productivity in India especially in Northern states like Punjab and Haryana.

Patil et al. (2012), in the study of onion found that there is need to educate the onion growers by extension agencies for adoption of recommended dose of fertilizers and plant protection measures and net income of the adopters is better than non adopters.

Ojha et al. (2013). the study entitled "Evaluation of Technology dissemination through demonstration on the yield of kharif onion" revealed that the technology gap was reduced by technology dissemination through demonstrations under NHM, Government of India at adopted farmers field.

Shivaji Chandrakant Waykar (2013), study was observed that all the onion growers (100%) adopted the practices such as selection of varieties having good storage capacity, selection of improved onion seed, use of chemical herbicides and storage of onion in shading. The practices which were adopted by majority of onion growers were pest and disease control measures (68.18%), addition use of nitrogenous fertilizers (63.64%), selection of varieties having good storage capacity, selection of improved onion seed, use of chemical herbicides and storage of onion in shading.

The practices which were known to large majority of onion growers were sowing of onion. In nursery bed size, pest and disease control measures (79.09%), addition use of nitrogenous fertilizers (63.64%), grading of onion (42.72 %).
Asif reza et.al. (2015), study revealed that quality of extension service and access to credit are the two most important factors that contribute to adoption. The adoption level was high among the educated farmers and fragmented lands reduces the adoption probabilities.

2.4.2. Age and adoption

Alavatti and Sundarasamy (1990) observed that age showed non-significant association with adoption.

2.4.3 Size of family and adoption

Nikhade and Thakare (1985) reported that size of family had significant association with use of fertilizers.

Sharma et.al. (1987) revealed that, family size was significantly associated with adoption of improved farm technology by the participation of farm families in lab to land programme

Takate (1987) corroborated that, size of family was not associated with the adoption of improved irrigation water management practices.

Plethora of earlier research studies (Nalawade (1989), Nikhade and potdar (1989), Deshmukh (1991) confirmed that adverse result shown in their adoption of kharif potato, banana and kisan nursery management practices.

2.4.4. Communication technologies adopted by extension workers

Roger and Yost (1960) reported that extension specialists, experimental station bulletins, farm magazines and direct contacts with experimental stations were the most important sources of information for country agents of Ohio in USA.

Ray (1975) observed that the extension officers were mostly in contact with official letters, leaflets/ pamphlets, folders, agricultural magazine and official meetings for getting information.

Sridhar and Reddy (1977) concluded that farm and home visits, leaflets, office calls, group meetings, method demonstrations and result demonstrations were the important methods for information dissemination in the descending order. Further revealed a greater use of farm and home visits and office calls by agricultural
assistant, leaflets by Assistant Agricultural Officers, telephone calls, circular letters, personnel letters, film shows and study tour by Assistant Director of Agriculture/Deputy Director of Agriculture.

Dandu (1977) found that 76.02% of respondent performed information dissemination and they are been ranked third.

Bottinger and Stafford (1997) reported that information and communication techniques are able to support the economical optimization of agricultural enterprises.

Heong et.al. (1998) observed that by means of distribution of carefully designed communication media material. Such as leaflets, radio, drama and posters it would be possible to have the most effective reach. Thirty one months after the media introduction, the number of insecticide sprays dropped significantly from 3.35 sprays per farmer preseason to 1.56. The proportion of farmers spraying at early and late tillering and booting stages of paddy crop was reduced from 59.84 to 0.2, 85%, 19 and 30% respectively.

Naikin et.al. (1998) reported that multimedia campaigns of weed management have created significant impact in minimizing grassy weed problems of rice in the muda area of Malaysia.

2.4.5. Age and technological gap

Kubde and Sinha (1983) found that there was a negative correlation between age and technological gap in both progressive and non-progressive village.

2.4.6. Education and technological gap

Ray et.al. (1995) found that there was no relationship observed between education and technological gap in the adoption of agricultural technology.

2.4.7. Size of family and technological gap

Bhoite (1983) reported that family size had positively significant relationship with technological gap in adoption of jower technology.

2.4.8. Social participation and technological gap

Bhoite (1983) found that social participation had negatively significant relationship with technological gap in adoption of jower technology.
Ray et al. (1995) found that there was non-significant relationship between social participation and technological gap in adoption of agricultural technology.

2.4.9. Source of information and technological gap:

Dharmale (1993) found that the sources of information were positively and significant correlated with the adoption level of the respondents.

Maghade (2007) found that there was negative and highly significant relationship between sources of information and technological gap in onion cultivation

2.4.10. Size of land holding and technological gap

Patil (1995) found that there was negative significant and negative correlation between size of land holding and technological gap.

Koli (2003) observed that there was a highly significant association between size of land holding and knowledge level of the onion growers about onion production technology.

Maghade (2007) found that there was negative and highly significant correlation between size of land holding and technological gap in adoption of improved practices of onion cultivation.

2.4.11. Annual income and technological gap

Waman (1993) observed that the annual income was significantly associated with adoption level of onion growers.

Maghade (2007) reported that there was negative and highly significant correlation observed between annual income and technological gap in adoption of improved practices of onion cultivation

2.4.12. Occupation and technological gap

Bhati (2002) reported that occupation of all the three (Small, Medium and Large) categories of farmers was non-significantly related to the overall technological gap in the recommended mustard production technology.
Bhat (2005) reported that occupation of the respondent paddy farmers was significantly and positively correlated with technological gap.

2.4.13. Socio-economic status and technological gap

Hayami et.al. (1990) observed that by the adoption of modern rice varieties, socio-economic status of farmers improved.

Singh (1998) concluded that socio-economic status was one of the responsible factors for wide technological gap in cotton crop.

2.4.14. Risk orientation and technological gap

Bhoite (1983) revealed that there was negatively significant correlation between risk preference and technological gap in adoption of jower technology.

Maghade (2007) found that there was negative and highly significant correlation between risk orientation and technological gap in adoption of improved practices of onion cultivation

2.4.15. Marketing behaviour and technological gap

Waman (1993) revealed that majority (78 percent) of the onion growers marketed their produce through commission agents.

2.5.16. Technological gap on adoption

Pravin Lalaso Jadhav (2009), study was observed that high technological gap in onion practices such as seed treatment (57.54%), disease management (53.60%) and use of chemical fertilizers (50.48%) followed by medium technological gap in pest management (43.27%) and use of improved varieties (39.07%).

2.4.17. Storage and marketing pattern followed by the farmers

Patil and Jadhav (1987) concluded that about 10 percent of the farmers stored their produce. About 6 percent of them stored the produce in their houses, while 2 percent each stored it in farm shed and under shade of the trees.

Waman (1993) revealed that most of the onion growers (81.33 percent) stored their onion produce by local method (chawl method) and only few (18.67 percent) of onion growers stored their onion produce by improved method (chawl with bottom ventilation method).
Pandey *et.al.* (1997) noticed that the breath of chawl is 4-5ft. and height of onion in the chawl was 3-4 ft. the storage losses were reduced by providing base ventilation and by this method onion could be stored upto six months in good condition.

Gadilkar (1998) revealed that majority of onion growers (64.44 percent) used store type storage structure which was built near their residence. 54.44 percent of the farmers constructed their chawl in north-south direction and was built by their family members using sand and gravel for the floor.

Sadaphal (2000) reported that nearly all the respondents (99 percent) stored the onion produce mostly by preparing onion wreaths, putting them in heaps and hanging them on bamboo (66.67 percent). All the respondents had stored the produce in their house itself for a period ranging from 9 to 15 days.

Rao *et.al.* (1967) reported that the temporary storage structure of onion using local materials such as wooden poles, bamboo and straw at a height of 2 m and 1 m wide and as long as needed were built by the respondents.

Laul *et.al.* (1984) reported that in Nasik area, the onions were stored in chawls there was no ventilation in the base and the losses were much more. The ventilation was needed for the storage structure.

Vishwanatha *et.al.* (1989) observed that in the chickballapur area, farmers have adopted similar storage techniques known as pendi. The structure made from bamboo walls, there is no ventilation in the base and got much more losses.

Denton *et.al.* (1990) reported that the farmers use various storage methods and storage losses were 50 percent to 75 percent in local storage structures. Storage of onion in good ventilation storage structure reduces the storage losses of the onion.

Tyagi *et.al.* (1991) mentioned that chawls were used in the Maharashtra region, Haryana and in Uttar Pradesh. They stated that farmers built storage by bamboo and similar types of materials and added that the structures in Maharashtra and Uttar Pradesh could not be aerated from the base, while those in Haryana could be aerated. They concluded that graded produce stored in structured with bottom aeration suffer far fewer losses than non-stored bulb stored in in-ventilated stores.
Kale et al. (1992) reported that conventional onion storage structures called chawl was traditionally used by farmers and also traders for onion storage in Nashik district. There was no aeration at bottom, as onion was stored upto height of 1.5 to 2.0 m or upto roof of chawl. Thus, creating pressure on lower layers of onions bulb resulting into a lot of bruising and decay. They reported an improved onion storage structure with bottom ventilation and raised floor 60 cm above ground level. A comprehensive trial to study the effect of improved storage structure was initiated in 1982. The result indicates that the provision of central and bottom ventilation in storage structure reduces losses from 92.2 to 70 percent during five months storage.

Musa et al. (1994) suggested that improved onion storage was possible using traditional straw stores provided the onions were raised on a platform 150 mm above the ground. So countering the problems associated with ground moisture and aiding ventilation.

Koli (2003), study was observed that more than half of the onion growers (52.50%) had stored onion by local methods, while 20 percent of them stored in improved storage structure and 27.50 percent of them used gunny bags for storage. More than half of the onion growers (60.83%) had stored onion in their fields while 39.17 percent of them stored in their house.

2.4.18 Adoption of storage practices

Matos (1987) described traditional onion storage structure in southern Brazil as being very ‘precarious’ with losses often reaching 40 to 50 percent of the total.

Hyden (1989) reported that growers recognized the need to store bulbs under very good ventilation and examined bulbs regularly during the storage period to remove decaying bulbs. The growers expressed preference for straw stores because they consider ventilation in such storage structure is better than in mud storage structures.
2.5. Constraints in onion production:

2.5.1 Concept and meaning

One of the important specific objectives of the study was to analyze the constraints and problems faced by the onion growers in cultivation, storage and marketing of onion.

The Oxford English Dictionary (1961) defined that, constraints as a confusion, bound or fettered condition restriction of liberty or free action.

According to the American Heritage Dictionary (1969), constraints are the stage, quality or sense of restricted course of action or inaction.

Kothikhane et.al. (1987) observed that, unsuitability and use of improved farm implements, high cost of inputs such as fertilizers, pesticides, non-availability of inputs at proper time and inadequate quantities, low price of farm produce, non-availability of resources at farmers level, lack of proper irrigation schedule, conflicting attitude of departmental personnel, problems of development of salinity due to prolonged use of irrigation were the prominent constraints of the farmers and confirmed that the area which hinder in adoption of agricultural technology appropriately under irrigated farming system on their farms.

Pandey (1990) stated that, the major constraints in development of horticulture were lack of data base for identifying the priorities and gap in perspective planning, inadequate availability of appropriate genotype and quality planting material. Weak post-harvest management infrastructure, long gestation period and heavy initial investment coupled with inadequate finance and high rate of interest were the major constraints of horticulture crop production.

Singh (1991) revealed that, inadequate organizational set up, unreliable data on area, production, productivity, inadequate irrigation facilities, high cost and low use of fertilizers, no linkage with the other rural development programme, inadequate extension service, lack of organized marketing and transport, inadequate quality of seed, lack of preservation, post-harvest losses, lack of suitable varieties for processing and export, lack of cargo, lack of storage facilities and cargo space for export, inadequate budget. al. location were major constraints in vegetable production in India.
Waman (1993) revealed that majority of the onion growers faced the constraints such as labour problem during transplanting and harvesting of the onion (87.33 percent), high cost of fertilizer and seed (86 percent), non-availability of seed and planting material in time (67.67 percent), difficulty in identifying pest and disease (54.66) and non-availability of fertilizers in time (50 percent). Regarding storage the major constraints faced were lack of knowledge about non only improved method of storage (75.33 percent), but also grading (50.66 percent). In marketing the major constraints faced were low prices for onion (92 percent), fluctuation in market prices (86 percent) and high rate of commission (81.33 percent).

Ranganathan (1995) listed the constraints of rainfed sorghum cultivators that inhibit them adopting modern technologies. They were lack of rainfall (76.60%), lack of good short duration sorghum varieties (81.60%), lack of convictions of certain technologies (50.00%), lack of red grain varieties suited for cooking (34.00%) and lack of knowledge (33.00%).

Jeyasubramanian (1996) reported that the lack of information on the cultivation of medicinal plants was expressed as major constraint by 78.50 percent of the respondents. Lack of guidance on purchasing seeds, seedlings and saplings were constraints for 64.20 percent of the respondents.

Sakore (1996) found that all the farmers (100 percent) cited lack of scientific storage facilities in producing areas as the main constraint. 92 percent indicated widespread fluctuations in market prices as hurdle while lack of transportation and communication facilities in villages connecting them with markets was faced by 65.33 percent onion growers. The other major constraints faced were multiplicity of the market charges and commissions (68 percent) and inadequate availability of credit and seeds of good cultivars (61.33 percent).

Mohapratra (1999) reported that the major constraints in marketing of the onion produce are “unavailability of storage godowns, poor transportation facilities, lack of government support for marketing, non-availability of adequate institutional credit facilities at right time, illiteracy and backwardness of farmers and the lack of up-to-date market information.
Vijaylakshmi (1999) reported that lack of standard cultivation packages/agrotechnologies, no established sources to obtain authentic planting materials like seeds, plantlets, no proper marketing channel were the main constraints in cultivation of medicinal plants.

Anand (2000) stated that lack of required management and agricultural expertise, lack of financial resources was the major constraints in the cultivation of medicinal plants.

Maiti (2000) stated that lack of awareness, inadequate investment in research and development; manufacturer-exporter dissonance; lack of quality and standardization norms and lack of adequate marketing and trade information are the major constraints in the cultivation of medicinal plants.

Prabhakar (2000) reported that, the major constraints in cultivation of medicinal plants were lack of agencies to supply good quality seeds, non-availability of labour in time, insufficient research in medicinal plant based intercropping system, lack of processing industries, lack of proper marketing channel, and lack of fixed price policy followed by the Government.

Shantha Sheela (2001) reported that higher level (100.00%) of research and marketing constraints followed by four-fifth (80.00%) of production constraints like lack of good quality seed material, pest control measures and irrigation facilities, and more than two-fifth (45.00%) of storage and processing constraints were noticed among the growers of Gloriosa superba.

Maghade (2007) reported high cost of chemical fertilizers (91.67 percent), lack of knowledge about improved storage structure (80 percent), shortage of labour during weeding operation (64.17 percent), difficulty in identifying pests and diseases (64.16 percent), lack of knowledge about time of application of chemical fertilizers (53.33), Shortage of labour during harvesting period (53.33 percent), non-availability of quality seeds and planting material in time (53.33 percent), hand weeding time and labour consuming as well as expensive (51.67 percent), irregular supply of electricity (35.83 percent) were the major constraints for existing technological gap in cultivation practices of onion.
2.6. Suggestions for improvement of onion production

Waman (1993) noticed that majority of (90 percent) onion growers suggested that NAFED should give positive response for onion purchase, while, 88 percent of them expected stable market price for onion. Abolishment of sale tax and other taxes (85.33 percent), commission charges should be less (76 percent), sufficient credit at reasonable rate of interest (63.33 percent) and efficient and suitable transport facilities (52.66 percent), longer duration storage facilities (52.66 percent) and encouragement for export oriented production (38 percent) were the major suggestions of the onion growers.

Jeyasubramaniam (1996) reported that the guidance for marketing the produce 90.40 percent more information on cultivation aspects in booklet form 88.00 percent and contact programme to be conducted once in a month 73.80 percent are the major suggestions.

Phadartare (1999) revealed that 87.50 percent of the onion growers suggested that fertilizers and pesticides should be provided at subsidized rates in time, 80.83 percent respondents suggested establishing storage facilities and 75 percent of respondents suggested making available the timely and adequate supply of production inputs. Regarding marketing, 72.50 percent demanded that the commission agent should be under the government control and directed to take reasonable commission charges, whereas, 48.33 percent of them aspired for suitable transportation facilities.

Ghose (1999) suggested that large scale demonstration of technologies, vocational training of extension functionaries to upgrade skills for effective technology transfer. Linking producers and retailers with networking centers must receive urgent attention for promotion of medicinal plants.

Yadav (1999) suggested that in setting up a three tier training system which will involve the training of state development officials, research workers, at the central institute followed by the training of village level workers who in turn the farmers in order to bridge the gap between farmer and source agencies.
Baria (2002) stated that a functional collaboration among the private sector, NGOs, rural farming communities, banks, research institutes and Government departments which can make available package of practices and inputs, quality planting material and market intelligence.

Koli (2003), study was observed the majority of the onion growers were faced the constraints that non availability of seed and planting material in time (53.33%), high cost of fertilizers (91.67%), irregular supply of electricity (78.33%), labour problem for weeding (64.17%), difficulty in identifying pests and diseases (52.50%), labour shortage during the harvesting (53.33%), lack of knowledge about the improved storage structure (71.33%) and low prices and fluctuation in market prices (77.50%).

Sinde (2004) reported that practical knowledge regarding plant protection measures be improved (71 percent) was one of the important suggestions. The other suggestions were financial assistance in the form of subsidy (65 percent), making available good quality seed at reasonable rate (63.50 percent), easily available loan facilities (61 percent), and timely supply of seeds (57 percent), fertilizers (53 percent) and pesticides (51.50 percent)

Maghade (2007) observed the major suggestions those are stable market price for onion (74.16 percent), co-operative marketing societies be established (60.83 percent), government should fix the minimum support price for onion (78.33 percent), NAFED need to purchase onion at reasonable rate (58.33 percent), effective and efficient marketing system (57.50 percent), provision of quality seed and planting material with technical know-how (53.33 percent)

Pravin Lalaso Jadhav (2009), study was observed that high cost of FYM and fertilizers (84.61%), lack of knowledge of scientific and technical information about storage (73.84%), labour charges (71.53%), price fluctuation in market (71.53%), lack of knowledge about the application of chemical fertilizers (62.30%) and unavailability of recommended insecticides and pesticides (62.30%) were the major constraints faced by onion growers in onion production.
Shivaji Chandrakant Waykar (2013), study indicated that majority 74.34 percent of the onion growers reported that unavailability of skilled labourers as main constraints followed by 66.36 percent, 58.33 percent and 51.81 percent reported that high cost of micro irrigation system, unavailability of grading machine and high fluctuation in rates of onion in market were the major constraints.

Gibramu Abebaw Berhanu (2014) the study entitled "Constraints of onion (Allium cepa. var. cepa L) field production and food preference to shallot (Allium cepa. var. aggregatum) in due case of Bibugn Woreda Amhara Regional State, Ethiopia" revealed that the constraints on the majority of the onion growers were disease occurrence and irrigation sources.

2.6.1. Seed propagated aggregatum onion (Allium Cepa L. Var. aggregatum Don)

Anbukkarasi (2010), in her study finds that application of maleic hydrazide @ 2000 ppm + carbendazim @ 1000 ppm at 30 days before harvest and storing with 2 cm neck length of bulbs in low cost bottom ventilated storage structure increase the shelf life of aggregatum onion cv. C-On-5 up to six months.

Bharathi et.al. (2015), in their studies finds that seed propagated multiplier onion variety Co-On-5 gave yield of 25.5 Mt per ha which is higher than the bulb propagated type variety Co-On-4.

Umesh Acharya et.al. (2015), the experiment on the seed propagated aggregatum onion Co-On-5 to increase the yield, growth and quality parameters was conducted and results reveals that spray of zinc sulphate @ 0.5 % on 30 and 45 days of transplanting and soil application of Borax 10 kg per ha provided the highest yield.

Rohini and Paramaguru (2016), study revealed that when compared to free flowing types of aggregatum onion varieties such as Co-On-5, the yield of local variety Putharachal type gave better yield of seed (8.07 kg per ha) and residual bulb yield of 8,000 kg/ha under Coimbatore conditions.