CHAPTER II

REVIEW OF LITERATURE

In this chapter an attempt has been made to review the available literature relevant to the present study. In the recent past, considerable researches have been done in the field of dryland agriculture at different dry farming research centres with a view to increase and stabilize the crop yields in dryland tracts. But their economic feasibility has hardly been established. Thus site-specific research in the context of the present farming system and resource utilization under different situation to stabilize crop yields and income of the farmers is much more useful to gear up the dryland agriculture. Nevertheless the information available on these important aspects is limited and sketchy. However, the available literature on important researches and studies made on various aspects of dryland agriculture at different places are reviewed. The available literature is reviewed topic-wise, mentioned below.

2.1 WEATHER AND CROP PRODUCTION

The important weather variables which influence the crop production in monsoon dependent country like India are rainfall, soil moisture, maximum and minimum temperature, humidity etc. Very little work on this aspect is available in literature. However such work related to response of crop yields to rainfall and its distribution, moisture etc. are presented briefly.

Fisher (1924) while studying the influence of rainfall on wheat at Rothamsted, observed that the polynomial of the fifth degree as regression integral on rainfall distribution provided rainfall constants which accounted for 11 to 40 per cent of the variation in yield of wheat. He reported that one should consider not only the total amount of rainfall during the season but also its distribution.

The effect of rainfall distribution on yield of groundnut in Raichur area of the then Mysore State was examined by Singagi (1964). He indicated that well distributed rainfall ranging from 575 to 625 mm found to be quite sufficient to obtain good yield of groundnut. Heavy

rainfall had no effect on yield and the insufficient raiifall during July and August i.e. at vegetative and flowering stages of the crop had been found to effect adversly the crop yield.

Borude and Joglekar (1971) in their study on Crop Insurance to protect farmers under Dry Farming conditions in Maharashtra observed that per acre yield of irrigated Jowar (Sorghum) was four times more than that of rainfed Jowar but the fluctuation in yields of irrigated Jowar were necessarily lessor than the rainfed Jowar indicating that the risk to production of Jowar under dry farming condition is always greater than that under irrigated condition.

Das and Ramchandran (1971) while forecasting yield of bajra (pearlmillet) on the basis of weather parameters for Ahmedabad district in Gujarat, could locate the period in which the rainfall had some significant correlation with the yield of bajra. They found that the variability of rainfall during such period was more than 200 per cent. Further they found that if there was no rain for 21 days

or more continuously during the crop growth period, the yield was reduced substantially.

Holford (1971), based on his study on the effect of rainfall on yield of groundnut in Fiji, reported that groundnut yields were positively correlated (r = +0.994) with rainfall received during the first 64 days of crop growth period i.e. from sowing to maximum flowering.

The effect of rainfall distribution on yield of groundnut in Saurashtra during 1945-70 was studied by Joshi and Kabaria (1972). Their study revealed that neither total nor the number of rainy days had any relationship with the yield. However, the rainfall from full pegging to pod development (51-80 days) stage was significantly correlated ($r = 0.523^{**}$) with the yield. The most critical period was found to be the week from full pegging to early pod development (51-57 days after sowing). A decrease in 1 mm rainfall during this week reduced the yield by 3.27 Kg/hectare of groundnut. The multiple linear regression equation of yield and rainfall during 1 - 50 days (X_1), 51 - 80 days (X_2) and 81 - 100 days (X_3) after sowing could account for 64% of the total variation.

Cheema et. al. (1974) in their study at Ludhiana in Kharif season found that there was no significant difference between yield of groundnut grown under rainfed condition and that when crop was given up to 10 irrigations, indicating that groundnut could be grown successfully under rainfed conditions during the years of well distributed rainfall.

Lemmason (1974), in a study covering a period of 68 years (1878 to 1946), on the influence of rainfall on prosperity in eastern Montana observed that probability of getting a bumber crop in this 'Wheat Region' was not more than one year out of twenty three while complete crop failure, as a result of drought, expected one year out of seven years.

Boote et. al. (1976) in their field trial at Florida found that three weeks of drought induced during 8 - 11 week of growth of groundnut crop had no significant effect on pod size but it significantly delayed the maturity of the crop.

Parmar and Gandhi (1981) while analysing the rainfall data for 23 years (1958 to 1980) found that the distribution of rainfall is very erratic in nature affecting the crop

badly in such areas.

Pathak and Patel (1983) in their study on 'Growth of Agricultural production in Gujarat' found that the fluctuation in productivity of rice, sorghum, pearlmillet, pulses and groundnut were highly correlated with the rainfall.

2.2 INVESTMENT ON FARM RESOURCES

Garg and Singh (1971), while studying the income disparity between dryland and irrigated farms observed that the investment in fixed capital was significantly higher on the irrigated farms than on the dryland farms. The calculated value of K between the investment in fixed capital on irrigated farms and that of on dryland farms came to above 18.02.

Maral and Waghmare (1971) found a closer association between maintenance of draft animals and the size of farms on dryland farms of Sholapur districts of Maharashtra. The average number of draft animal possessed by farmers under each of the size-groups were 1.14 animals in small size,

1.45 in medium size and 1.85 in large size holdings. They also noticed positive relationship between the average investment in capital assets per farm and and the size of land holding.

Maruti and Prasad (1971) in their study found that investment in fixed capital decreased with the increase in the farm size as average investment in fixed capital under 0 - 2 hectare size - group was Rs.4107.48 while it came to Rs.3685.69 per hectare in the largest size-group and averaged to Rs.3822.79 per hectare.

Jodha (1977) in his study on 'Resource Base on Determinent of cropping Pattern', noticed positive relationship between the average value of farm equipments and the farm size in five out of six selected villages.

Yadav and Varma (1977) found that per hectare investment in fixed capital decreased with the increase in farm size. Per hectare total investment in fixed capital was Rs.7542.44 in smallest size-group (0-1 ha) which came down to Rs.5841.30 in the largest size-group (4 hect. and above).

Ram Iqbal Singh et. al. (1980) argued that the average investment in fixed capital per farm with and without land showed an increasing trend with the increase in farm size. The smallest size-group had the lowest per farm investment in fixed capital (Rs.6892.62 with land and Rs.1780.47 without land) and it was highest for the biggest farm size-group (Rs.69089.73 with land and Rs.17778.89 without land).

Rangaswami (1981), while analysing cost composition in drought prone areas of Hissar district in Haryana, found that human labour is the chief component forming 73 per cent and 66 per cent of the total costs for local and hybrid bajra, respectively, whereas chemical fertilizers formed only 10 per cent of the total cost for hybrid bajra.

2.3 UTILISATION OF LAND AND OTHER INPUTS

Rao's (1964) study based on Farm Management Studies data reveals that per acre cost of cultivation declined as the size of farm increased in Uttar Pradesh, Punjab, West Bengal and Madras. In contrast, in Andhra Pradesh, Madhya

Pradesh and Bombay, it had not shown any systematic relationship between different size-groups.

Yeshwanth (1965) while studying economics of well irrigation noticed that the cropping intensity was very high on irrigated farms (168%) as compared to that on dryland farm which was only 100 per cent, indicating no scope for multiple cropping on dryland farms.

Vishwa Nath (1969) observed that the cost of human labour, bullock labour and the total cost of production per acre decreases as the size of farm increases for dry as well as irrigated paddy, wheat, barley and sugarcane. In each size-group, the cost of each input (except seeds) and total cost per acre for the cultivation of unirrigated crops are lower than that of irrigated crops.

Anonymous (1970), research study conducted by the National Council of Applied Economic Research, highlighted that dryland farmers for want of adequate rainfall and irrigation facilities used to grow only one crop of short duration, indicating low intensity of cropping in such areas.

Garg and Singh's (1971) study indicated that per hectare cost of input on dryland farms (Rs.503.57) was a bout 2.5 times less than that on irrigated farms (Rs.1393.93). The calculated value of t for per hectare cost of inputs between dry and irrigated farms came to 14.28 which was significant at 5 per cent level of significance. Singh, Bhatia and Azad (1971) also found that the use of inputs like human labour, bullock labour and fertilizers per hectare was higher on irrigated farms then that on dry farms.

To findout the difference in cropping intensity between irrigated and dry farming, Kahlon et al, (1971) applied the paired t test. The calculated t value worked out to 3.457, which was significant at 1 per cent level of significance, indicating that the intensity of cropping in irrigated farming was significantly higher (131.62%) than that in the dryland farming (88.87). But the cropping intensity showed a tendency to decline with the increase in the size of holding both in irrigated and dryland farming.

Maruti and Prasad (1971) also found that the intensity of cropping declined with the increase in the farm size and ranged between 110.87 to 100.05 per cent, the average being 103.57.

Sampath and Ganesan (1972) in their study on " "Economics of Dry Farming in Tamil Nadu" observed that cost of human and bullock labour along accounted for 52 per cent of the total cost of production on Groundnut. In case of cotton it accounted for 67 per cent.

Nishar (1975) found a positive relationship between cropping intensity and irrigation; and between cropping intensity and farm size. The average cropping intensity in the irrigation command area for sample beneficiaries increased from 131 per cent in 1967-68 to 151 per cent in 1968-69, whereas it remained practically constant (106%) for the area outside the command area. He also observed that the cropping intensity increased with the increase in the farm size.

Garg et al (1977) found that intensity of cropping varies positively with the farm size, as it was 150.64 per cent

on the smallest size group and 158.53 per cent on the largest size-group. Though there is variation in the intensity of cropping with the change in the size-group, yet the variation is not highly significant. It is mainly because of the level of irrigation on all size-groups was more or less uniform.

Yadav and Varma (1977), while assessing the input costs found that bullock labour cost and human labour cost together accounted more than 75 per cent of the total cost while manures and fertilizers and irrigation accounted 5.81 per cent and 0.28 per cent, respectively. Further, it was found that bullock labour cost is highest on small size-group of holding which may be repeated tillage operations performed by small farmers.

2.4 PROFITABILITY OF FARMING

Vishwanath's (1969) study reveals that profit per acre increases with the increase in the farm size, as per acre total cost on inputs declines at a higher rate than that of gross output with the rise in the farm size. In

each size-group, profit per acre for irrigated crops is higher than that for rainfed crops.

According to Garg and Singh's (1971) study, on an average, net income per hectare on dryland farms worked out at Rs.413.77 as against 1971-17 on irrigated farms. The computed value of t between net income on dryland farms and irrigated farms came to 21.34, which was significant at 5 per cent level. The input-output relationship was higher on irrigated farms as compared to dryland farms. One rupee of investment on dryland farms yielded an output of Rs. 1.82 as aginst Rs.2.41 on irrigated farms.

Singh, Bhatia and Asad's (1971) study concluded that the net income per hectare on irrigated farms was higher than that on dryland farms. The output-input ratio was also higher on irrigated farms with an average of 2.21 as against 1.98 on dryland farms.

Rangaswami (1981) in his study concluded that the response of fertilizers under dryland conditions depends on the availability of soil moisture in terms of rainfall without which costly inputs may result in loss. Use of

fertilizer is profitable only in good year i.e. with adequate and well distributed rainfall. He found that improved cultural practices are quite paying, yielding a net return of Rs.318 per hectare in a good year (1978) and Rs.32 in 1979 (a drought year) in case of hybrid bajra (pearlmillet).

2.5 ECONOMIC EFFICIENCY OF INPUTS

Majority of the studies that have dealt with the question of difference in economic efficiency between small and large farms, have generally come up with the conclusion that the small farms are more efficient than the large farms as they tend to utilize inputs of land and labour at optimum level as compared to large farms. Several studies based on Farm Management in India in mid-fifties also indicate an inverse relationship between productivity per acre and size of farm.

Radhakrishna's (1964) study has shown that the marginal value product of land has a positive relationship with irrigation as in irrigated area marginal value product of land (Rs.108.90) was about 1.7 times of that in dryland

areas (86.49), whereas marginal value product of a man-day human labour and pair-day bullock labour in irrigated area (Rs. 0.62 and Rs.1.82, respectively) was less than those in dry areas (Rs.1.22 and Rs.6.05, respectively).

In Rao's (1964) study the marginal productivity of land and labour for partially irrigated farms (Rs.4.74 and Rs.1.75, respectively) was higher than that for dryland farms (Rs.3.31 and Rs.1.28, respectively).

According to Sen (1964), small farms are more efficient than the large farms in the economic sense. To explain this inverse relationship, he argued that smaller farms are characterised by peasant family cultivation and the larger farms by capitalist cultivation. This shows that cultivation is carried up to the point where the marginal productivity of labour is zero on smaller farms while on larger farms cultivation stops at the points where productivity of labour equals the market wage rate.

Kahlon, et al. (1971) found that average yields per hectare of different crops were higher in the irrigated area as compared to those in the unirrigated area. The low yields

in the dry areas can be partially attributed to the fact that little fertilizers and other yield increasing inputs were used in raising these crops.

Sisodia and Agarkar's (1971) study reveals that the marginal value product of land is the highest on small farms and it tends to decrease with the increase in the farm size. The marginal value product of human labour on partially irrigated farms is more than double of that of the dry farms. The marginal value product of bullock labour, on an average, is negetive on both irrigated and dry farms

Gangawar and Ghakhar (1975) reported that marginal physical value of irrigated land was found to be about 5.2 times (Rs.3202.90) higher than that of unirrigated land (Rs.609.44) at the improved level of technology.

Shrinivas Prasad (1976) reported that the gross profit significantly increase as the size of holding increase. He further, reported that new profit was also lowest in small groups and there was increasing trend with increase in farm size indicating possible economies of scale and better use of resources.

Bagi's (1980) study showed inverse relationship between per hectare productivity and size of farm. He argued that small farms are making intensive use of inputs as compared to large farms. Findings of the studies by Bardhana (1973) and Bhardwaj (1974) also supports the findings of Bagi's study.

2.6 ADOPTION AND IMPACT OF TECHNOLOGY AND FARMER'S CONSTRAINTS.

Sturtevant (1887) of the New York Agricultural Experimental Station reported that cultivation is not beneficial to the corn plant except so far as removing the weeds. He reported a yield of 70.5 bushels per acre where the weeds were pulled by hand and 56.8 bushels on cultivated plots.

Kanitkar (1944) discussing the experimental results under dry farming scheme stated that there was no appreciable difference in yields of cotton from plots that received interculturing and those that no received interculturing at Hagari. Similarly, at Bijapur also he found no significant

difference in the yield of Jowar crop from intercultured and control plots on deep black and limy soils. He further observed that even at Sholapur intercultured plot failed to give significantly higher yields of Jowar than the controlled plots.

Bedekar (1955) observed that interculturing in Cotton did not offer any advantage during two out of three years experimentation in Hyderabad.

Roy (1960) observed that lack of conviction about utility of improved practices, lack of irrigation facilities and high initial cost of innovations were the major factors associated with low level of adoption of improved agricultural practices.

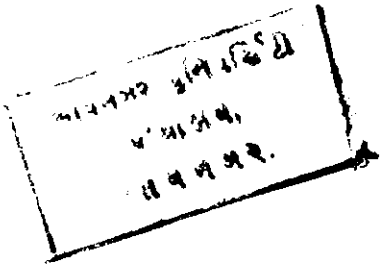
Sahay (1961) while studying the influence of size of farm income and farming efficiency in the adoption of improved agricultural techniques found curvilinear relationship between adoption and farm size. He found that the number of adopters and extent of adoption of improved seeds and fertilizers were highest in case of farmers having medium size farm (10 to 20 acres). He however, found that adoption of compost was

not related to size of farm or farm income.

Narayan (1965) while studying the farmers' attitude in adoption of farm technology observed that majority of farmers were prejudiced towards the use of improved seeds and fertilizers. According to him, farmers believed that improved seeds did not taste well and could not be digested easily. Similarly, farmers also believed that fertilizers spoiled soil fertility. Such negative attitudes of the farmers were mainly responsible for non-adoption of improved agricultural practices.

Chaudhary and Maharaja (1966) reported that higher level of income, better schooling of farmers and large holdings accelerated the rate of acceptance of improved agricultural practices.

Singh and Gupta (1971) reported that in the dryland areas, farmers were fully acquainted with the technological advances in the production of crop but any lag in their adoption was mainly because of lack of assured irrigation.



Anonymous (1972) while studying the impact of dry farming technology through result demonstration on farmers' fields in low rainfall districts of Rajkot, Jamnagar and Kutch for six years (1965-70) observed that, on an average, 46 per cent and 48 per cent higher yields were obtained under dry farming methods than the local methods adopted by the farmers in case of groundnut and hybrid bajra, respectively.

According to Arnon (1972), low plant population and wider inter row spacing were the major factors limiting groundnut yield. At Peanut Research Station, (North Carolina), highest yield of 3950 kg/ha was obtained in case of closer spacing (45 cm bet. two rows) whereas 3400 Kg/ha was obtained in case of 60 cm between two rows.

Mahale and Jha (1972) in their study observed that even in case of low pest infestation return to optimum pesticide usage were quite high in cotton crop.

Ojha (1972) reported that the spread of the new technology to dry farming in the state of Tamil Nadu was being restricted due to inadequacy of credit supply and marketing organisations.

Lal Gupta, et al. (1973) reported that the adoption of soil conservation practices has resulted in an increase of about 57 per cent in the intensity of cropping in the project area.

Krishnaswami and Patel (1973) in a bench mark study undertaken in Bellari (Mysore) and Panchmahals (Gujarat) observed that there does exists a package of dry farming technology and most of the elements of this technology were known to the farmers. However, extent of adoption of this technology was far from satisfactory. They also observed that the approach towards its adoption was piece-meal.

S.P. Gawada, et. al. (1974) while evaluating the soil and water conservation programme in Madhya Pradesh found that there was about 15 per cent increase in yields of wheat and groundnut due to bunding. In case of maize and cotton higher yields obtained due to bunding was of the order of 4 and 3 per cent, respectively.

Rao and Rastogi (1977) reported that though the improved dry farming technology has been exposed in the dryland tracts of Hyderabad through appropriate extension methods

and incentives by way of subsidies, the persistence with the adoption was not high enough, essentially due to shortage of capital.

Mehta (1978) reported that the non-availability of working capital appears to be the most common constraint affecting the decision process of adopters in Punjab.

Rastogi, B. K. (1978) on the basis of data collected in a pilot study conducted during 1975 at seven locations of the 23 research locations under the AICRPDA, concluded that on an average, farmers were using fertilizers less than recommended doses, mainly because of high cost of fertilizers, shortage of capital, fear of heavy loss and non-availability of fertilizers.

Jadav and Babaria (1979) while studying the impact of 150 farm ponds prepared in seven villages of Upleta taluka in Rajkot district during the period from 1973-74 to 1977-78 found that area under irrigation increased from 12.40 per cent during 1973-74 to 58.82 per cent in 1977-78. Consequently, the land use index increased from 101.60 per cent to 141.56 per cent during the same period.

Parmer and Paida (1979) in their study on profitability of inter-croping system under rainfed area observed that no inter-crop of green gram, black gram, castor, pigean pea and pearlmillet grown with groundnut in the ratio of 1 : 1 was suitable in terms of yield and overall economics of the system. However, they reported that the maximum realization per hectare (Rs. 3781/-) was obtained by growing groundnut and castor in the ratio of 3:1, giving an additional income of about Rs.450/- per hectare as compared to groundnut grown alone as a sole crop. This was followed by crop mixture of groundnut and pigeon-pea in the ratio of 3:1 giving an additional income of about Rs.219/- per acre over groundnut grown alone.

Kanwar (1980) in his overview address to the symposium on development and transfer of technology of rainfed agriculture stated that farmers of semi-tropical area faced three types of constraints to increased crop production. These include climatic risk which mainly relates inadequacy of moisture during crop growing period, the soil constraints, related to low water holding capacity,

increased run-off of rain water and relatively poor plant nutrient resource base and technological and socio-economic constraints related to traditional subsistance nature of agriculture in these regions and farmers appreciation of the steps in practicing modern technologies and availability of inputs.

Kanwar and Hooda (1980), while analysing the yield gap of dryland crops found that the yield gap exists mainly because of low level adoption of improved technology on farmers' field.

Pandian (1980) reported that by adopting full dry farming technology pearlmillet yielded an additional income of Rs.880.40 per hectare. Towards this income fertilizers contributed maximum share upto 47.67 per cent, while improved seeds accounted for 33.02 per cent and 15.44 per cent, respectively.

Rastogi (1980) while analysing two years data (1978-79 and 1979-80) for different AICRPDA centres observed that at Rajkot centre even under unfavourable weather season of 1979-80, low cost practices such as seed rate, row distance and thining of crops were found to be the

the important factors to mitigate the weather effects. He also noted that, on an average, improved seed, fertilizer application and improved cultural practices increased the gross income per hectare by Rs.380/-, Rs.660/- and Rs.249/- respectively.

Singh (1980) reported that the availability and application of technology is constrained by the structure and magnitude of resource endowment, which in turn, is conditioned by agrarian structure prevailing in the economy.

Suryawanshi and Gaikwad (1980) found that high monetory returns are associated with the use of recommended variety, fertilizers, timely sowing and interculturing in sorghum crop.

Pa tel's (1981) study showed that the adoption of the recommended dry farming practices resulted in the increased yield to the extent of 35% in groundnut, 199% in sorghum, 85% in pearlmillet crop over the traditional method.

Rastogi (1981) while analysing the yield data for different locations under AICRPDA observed that average

yields of sorghum increased from 8.6 q/ha to 14.7 q/ha, that of pearlmillet from 4 q/ha to 10 q/ha and of groundnut from 5.8 q/ha to 7.3 q/ha due to adoption of improved agricultural practices.

Singh (1981) found that high cost of seeds and non-availability of recommended crop variety, high prices of fertilizers and pesticides and lack of proper technical guidence were the major reasons for non-adoption of these inputs.

Rangaswami (1982) while studying the relative profitability of dry farming technology observed that net return per hectare of cotton crop obtained under the improved method was Rs.1214/- as against Rs.127/- under traditional method.

Rastogi and Reddy (1982) in their study of farm structure for different centres observed that highest net returns per hectare were obtained by the farmers covered under the pilot project area as compared to DPAP areas and new project areas in case of all the major dryland crops such as groundnut, pearlmillet, sorghum and

cotton. They also observed positive correlation between net return per hectare and size of farm and argued that it may possibly be due to better resource availability with the big farmers.

Anonymous (1983) reported that 1, 2 and 3 supplimentary irrigations to groundnut (All-334) over no irrigation, gave additional yield of 433, 866 and 996 Kg/hectare, respectively.

Friesen (1983) reported that estimated crop losses due to weeds in India ranged from 10 to 27 per cent of the total crop production.

Kanwar and Rego (1983) reported that the response to the application of fertilizers is strongly influenced by the simultaneous introduction of improved agronomic and water management techniques in the deep black soils.

Rastogi (1983) while analysing yield gap observed that majority of the sample farmers did not use fertilisers because of high price of fertilisers, shortage of capital and fear of heavy losses in case of failure of rain. Similarly, high cost of plant protection was the major reason for non-adoption of plant protection measures in crops

like sorghum, pearlmillet, groundnut, castor. He also stated that significantly, lack of awareness or knowledge about the recommended technology as a constraint was only of minor importance.