CHAPTER-II
REVIEW OF LITERATURE

Review of literature was collected as per the objective of the study. It has been presented in the following pages.

Characteristics of dry land farmers

Chauhan et al. (1987) reported that 58 percent farmers were illiterate; 71 percent had small level holding; 70 percent did not take credit and 53 percent had low extension contact in the arid area of Rajasthan.

Tawade and Deshpande (1990) found average age 51 years, education upto sixth standard, medium size family with average six members and average land holding 4.34 hectare of the beneficiaries of soil conservation cum-horticultural development scheme.

Singh and Talukdar (1990) reported that the farmers of hills and plain differ in relation to their main occupation, family type, family size, size of operational land holding, contact with extension workers, economic motivation and risk preference.

Makkar and Dhaliwal (1991) reported that 80 percent farmers had low education and 76.61 percent small size of operational holding.

Singh et al. (1996) reported that 76 percent respondents had age below 26 to 40 years, 61 percent illiterate, 55 percent high caste and majority of the farmers having 4 to 6 family members. A large number of farmers had agriculture as their main occupation and animal husbandry as the subsidiary occupation.
Farmers' source of getting information on the improved dry land technology

Bhaskaram and Praveena (1982) reported that most common source for the farmers in the experimental area were extension staff of the Dry Land Pilot Project. Other farmers and commercial agents formed the next important source and the VLW cited in only a few instances. The communication methods which had influence on the adoption of improved dry land practices included radio, demonstration, farmers training and field trips. The least methods were extension literature including magazines, educational film, poster exhibition, slide and lecture.

Singh and Prasad (1990) reported that demonstration and meeting with extension personnel were most important source of information and very little role was played by localite source for information for afforestation and salt affected soil.

Bhoite and Girase (1991) reported that participation in extension programme was very low as only 5 percent respondents attended training programme on agriculture campus. However, 50 percent farmers had high extension contact with extension functionaries.

Sinha (1991) reported that as many as 43.75 percent farmers did not know the village level worker.

Makkar and Dhaliwal (1991) reported that 70 percent farmers had low extension contact and 66.66 percent had no mass media exposure.

Supe (1991) reported that most of the readers read newspapers, periodicals, books and religious literatures but a small number of them read the extension literature produced by the Department of Agriculture.
Nadre (2000) reported the most important source of information was Gram Vistar mentioned by 60.70 percent. Another information sources were radio and television mentioned by 76.90 and 71.60 percent respondents respectively. Among the informal sources friend was reported by 38.40 percent respondents followed by relative (34.60 percent) and neighbour (32.70 percent).

**Knowledge of improved dry land technology among the farmers**

Rathore and Shaktawat (1990) found that majority of the farm women (61.66%) had low knowledge and 38.33 percent had high knowledge of pearl millet cultivation.

Singh et al. (1998) found that among the beneficiary of lab to land programme 57.50 percent had medium level of knowledge, 32.50 percent high level of knowledge and 10 percent low level of knowledge while among non-beneficiary 52.50 percent had medium level of knowledge, 37.50 percent low level of knowledge and 10 percent high level of knowledge of pearl millet cultivation.

Khalge, et al. (1998) found that 65 percent respondents had medium knowledge, 20.83 percent low knowledge and 14.17 percent high level of knowledge of pearl millet crop.

Kumar et al. (1991) reported that the farmers knowledge of chickpea and pearl millet production technology was very poor (about 30%).

Jagdale and Nimbalkar (1993) reported that large proportion of respondents in small, medium and large farmers' groups had medium knowledge level of improved dry land technology of rabi sorghum.
Khade et al. (1998) reported that majority of the respondents (64.16%) had medium knowledge, 19.16 percent high level of knowledge and 16.16 percent low knowledge levels of kharif sorghum.

Desai et al. (2000) reported that 67 percent farmers had medium knowledge and 33 percent high knowledge of recommended rainfed cotton technology.

Singh (1990) reported that majority of the farmers had low knowledge of improved paddy and maize practices in both Megalaya and Sikkim.

Soni and Chauhan (1997) reported that majority of the farmers (68.33%) had medium knowledge of improved practices of moth bean.

Gowda et al. (2000) reported that a vast majority (72%) farmers had low/medium knowledge on groundnut cultivation.

Krishna et al. (1990) found that Nilgiris farmers had medium level of knowledge towards soil conservation practices.

Bavalatti and Sudarashwamy (1991) reported that majority of the respondents (57.34%) had medium knowledge of dryfarming practices.

Bhople et al. (1991) found that 79.20 percent farmers had medium knowledge, 11.20 percent low knowledge and 9.60 percent high knowledge about the improved dry land technology.

Singh et al. (1996) found that 40 percent respondents possessed medium level of knowledge, 35 percent low knowledge and 17 percent high level of knowledge of improved dry land technology.

Chauhan, et al. (1987) reported that 49 percent farmers had low knowledge, 38 percent medium knowledge and 13 percent high knowledge of agriculture technology.
Bhaskaram and Praveena (1982) reported that large number of respondents had high level of knowledge about off-season tillage, mid season corrections, correct time of sowing of dry land crops, soil mulching, improved seed, correct seed rate, spacing, weeding and interculture; medium level of knowledge about fertilizer use, inter-cropping and sequence cropping and low level of knowledge about seed treatment, fertilizer spray of urea, chemical control of weeds, plant protection measures and improved agriculture implements.

Ramachandran and Sripal (1991) found that all farmers were aware of summer ploughing, pre-monsoon sowing, improved variety of cotton, broadcasting and line sowing, application of chemical fertilizer and farmyard manure, weedicide; 89 percent respondents were aware of the recommended dose of chemical pesticide; 66 percent were aware of the pheromone sex trap; nearly half of the respondents knew azospirillum application and only one fifth were aware of correct quantity of seed rate and seed treatments.

Kumar and Singh (1995) reported that medium and big farmers had relatively better knowledge about fertilizer than marginal and small farmers.

Purandare and Jaiswal (1993) made study in Maheswram watershed in Ranga Reddy district of Andhra Pradesh. They found that majority of the respondents were aware of soil and water conservation practices – contour bunding, vegetative barrier; improved crop husbandry practices – crop varieties, chemical fertilizer, double cropping and plant protection measures; alternate land use practices – horticultural crops but less number of respondents were aware of farm forestry.
Desai et al. (2000) reported that 64.50 percent farmers had medium adoption, 30.50 percent high and 5.00 percent low level of adoption of recommended cotton production.

Singh (1990) reported that in Meghalaya more than 87.14 and 82.86 percent of farmers were in low adopter category for improved paddy and maize practices respectively. In Sikkim, 98.00 percent were in medium adopter category of improved paddy practices and in case of improved maize practices, 88.00 percent belonged to medium adopter category.

Chauhan et al. (1987) reported that 41 percent farmers had medium level of adoption, 36 percent high adoption and 23 percent low adoption.

Bhole et al. (1991) found that 72.00 farmers had medium adoption, 24.80 percent low adoption and 3.20 percent high adoption.

Meti and Hanchinal (1995) reported that majority of respondents (56.66%) had medium adopter whereas high and low adopter respondents were 26.66 percent and 16.66 percent respectively of improved dry land technology of cotton.

Rajesh (2001) found 51.29 percent average level of adoption of improved dry land technology.

Reddy (1988) found no clear difference between beneficiary and non-beneficiary farmers in adoption of dry land technology at farmers' field Hyderabad, Andhra Pradesh.

Kude et al. (1991) indicated that dry land technologies advocated by All India Coordinated Research Project were not adopted by the most of the dry farming community.
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Natarajn and Nagaraja (1991) reported that no cost and low cost practices were adopted by large percentage of respondents compared to high cost technologies in case of finger millet.

Khalge et al. (1998) studied the level of adoption of pearl millet in Beed districts of Maharashtra and reported that deep ploughing, collection and burning of stubbles, three to four harrowing were fully adopted by 63.33, 75.00 and 66.66 percent of the respondents respectively; application of 15 cart load of FYM was followed by 54.17 percent respondents; seed rate (2.50 to 3 kg/ha) was fully adopted by 80 percent respondents; improved seed by 66.67 percent respondents; salt treatment by 12.50 percent respondents; sowing between 10 to 30th June was adopted by 91.66 percent and sowing at distance of 45 cm was adopted by 66.67 percent responded; 60:30:30 kg of NPK per hectare was adopted by 42.50 percent respondents; 2 and 3 hoeings was adopted by 75 percent respondents and spraying crop with cooper-oxy-chloride was adopted by 23.33 percent respondents.

Bhaskaram and Praveena (1982) reported that in case of sorghum, none of the recommended practices were adopted by more than 42 percent of the respondents. Improved seed, summer tillage, correct time of sowing and spacing, correct seed rate and interculture were adopted by 31 to 42 percent of the respondents and seed treatment, fertilizer use, urea spray, chemical control of weed and plant protection were adopted by a few farmers -1.5 and 26.50 percent.

In case of castor, use of improved seed was adopted by over two-third of respondents; post harvest and summer tillage, fertilizer use and weed control through interculture were adopted by 37 to 61 percent respondents. Only less than 27 percent of farmers adopted intercropping of castor, urea spray, chemical weed control and plant protection measures.
Saxena et al. (1990) reported that all farmers adopted method of land preparation, 72 percent proper spacing and time of sowing and 68 percent improved varieties but less percentage of farmer adopted plant protection and recommended dose of chemical fertilizer of rainfed wheat technology in Malwa region in Indore.

Jaiswal and Singh (1980) reported that the use of chemical fertilizer was very low. Only a few farmers (28%) used chemical fertilizer and 23 percent of the area out of total area was under chemical fertilizer. Among different categories, adoption was extremely low (10%) among marginal farmers, low (20%) among small farmers and moderate (50%) among big farmers. However, majority of the sample of farmers (73%) practiced the application of FYM. All big farmers, 60 percent marginal farmers and 68 percent small farmers used FYM.

Hebbar and Sholapurkar (1990) reported that the overall adoption of chemical fertilizer was fairly high in case of kharif sorghum, finger millet, wheat, pegoonpea and sunflower compared to pearl millet, rabi sorghum, bengal gram, groundnut and safflower.

Hebbar and Sholapurkar (1990) found that overall intensity of nitrogenous use was only about 50 percent of the recommended dose or less in all the dry land crops except in bengal-gram and Intensity of use of phosphorus was closer to the recommended dose in wheat and bengal gram while it was about 2/3 of the recommended dose of sorghum and finger millet and less than half of the recommended dose in pearl millet, pigeon pea, groundnut, sunflower and safflower.

Kumar and Singh (1993) reported that about one-tenth of marginal and one-fourth of the small farmers applied fertilizer in pearl millet but 60 percent of them applied nitrogenous below the recommended level. As high as about 70 percent of medium and big farmers used fertilizer and nearly 65 percent of them applied nitrogenous below the recommended level.
Farooq et al. (1997) reported that all respondents adopted the improved variety, chemical fertilizer and interculture operation while majority of them adopted farmyard manure (93.33%), deep ploughing (94.67%), crop rotation (97.33%), mixed cropping (83.33%) and contour cultivation (91.33%) in drought prone area in Aurangabad.

Bavalatti and Sundarawamy (1990) studied the adoption of improved dry land practices and found that majority of farmers adopted crop rotation (95%), farm yard manure (85%), fall ploughing (83%), deep ploughing (75%), contour cultivation (67%), and ridge and furrow cultivation (57%), while large majority of the farmers did not adopting terracing (93%), stubble mulching (85%), and strip cropping (73%).

Thakur et al. (1990) reported that cent per cent respondent did not adopt soil treatment, chemical fertilizer and plant protection; 92 per cent respondents used improved variety; 44 per cent adopted correct sowing time and 24 per cent adopted correct seed rate in rainfed wheat in Sagar district of Madhya Pradesh.

Purandare and Jaiswal (1983) found that adoption of soil and water conservation practices – contour bunding was quite high while it was low in case of vegetative barrier. Under recommended crop husbandry practices use of improved varieties of sorghum, castor and application of chemical fertilizer was significantly higher among the sample farmers. The adoption of recommended ratio of intercropping of sorghum + pigeonpea was not high. As a part of alternate land use practices horticulture was adopted by over 70 percent of the respondents. The farm forestry, agro forestry and pasture development were not at all popular among the respondents.
Farmers’ characteristics associated with knowledge and adoption of improved dry land technology

Rathore and Shaktawat (1990) reported that the knowledge of farmer was significantly positively associated with the level of education and size of family.

Bavalatti and Sundaraswamy (1991) reported that land holding and extension participation had positive and significant association with the knowledge of improved dry land practices.

Singh et al. (1996) reported that the knowledge of the farmer is significantly and positively correlated with education, farm implement, cropping pattern, participation in training and information source.

Jagdale and Nimbalkar (1993) found that there was significant positive association between education, size of family, annual income, social participation, socio-economic status, source of information, extension contact and cosmopoliteness with knowledge of improved dry land technology.

Gowda et al. (2000) found that economic motivation, scientific orientation and extension participation of farmers had significant positive relation with the knowledge level of improved dry land technology.

Krishna et al. (1990) reported that risk orientation, mass media, personal cosmopolite and personal localite showed positive and significant relationship with knowledge level of both adopters and non-adopters.

Singh (1990) reported that the contact of extension agencies and mass media influenced significantly the knowledge and adoption behaviour of farmers.
Saxena et al. (1990) reported that caste, size of land holding, education, farmers contact with extension agency was found positive and significant relationship with adoption of dry land technology in wheat.

Bavalatti and Sundarawamy (1990) reported that land holding and extension participation were positive and significant relationship with adoption level of dry land practices.

Bhoite and Girase (1991) reported that education and income had significant positive association with adoption of improved dry land technology.

Meti and Hanchinal (1995) reported that age, education, land holding and extension were positively significantly associated with adoption of dry land cotton technology.

Rao et al. (1997) reported that farm-related characteristics such as percentage castor area, and socio-economic characters, such as schooling, expected lose and credit, significantly influenced the farmers' decision to adopt plant protection measures.

Ingle and Wayazade (1989) reported that land holding, annual income and social participation were positively and significantly associated to the extent of adoption. The regression coefficient indicated 15 percent contribution of the variables in influencing extent of adoption.

Patil et al. (1989) found that education, size of holding, experience in farming and annual income were significantly associated with adoption of dry farming technology.

Problems in adoption of the improved dry land technology

Saxena, et al. (1990) reported that 65.60 percent farmers were not aware of the latest technology of rainfed wheat technology which was the most
important factor for non-adoption. Non-availability of the seed at right time and its cost also adversely affected reported by 32 percent and 44 percent of the respondents respectively. That the fertilizer application in dry land adversely affect the crop was found to be reason for non-adoption of it reported by 28 percent respondents. Non-availability of credit was mentioned for non-adoption by 32 percent respondents.

**Mundhva and Patel (1991)** reported that low market value of grain followed by lack of knowledge of latest variety and not suitable for the area was constraint in adoption of improved variety of wheat; non-availability of improved seed was the constraint for adoption of seed rate; lack of improved equipment and lack of guidance was for adoption of maintaining spacing; high cost was the problems in adoption of chemical fertilizer and lack of knowledge and high cost for the adoption of plant protection measures.

**Ramachandran and Sripal (1990)** reported that premonsoon sowing was not adopted by 7.50 percent respondents due to non-receipt of rainfall for long period of time. The non-adopter expressed that new varieties of rainfed cotton were susceptible to pest and disease. For non-adoption of Gorru the reason were: non-availability, broadcasting method easy, lack of experience with Gorru and presence of large number of morind plantation in the fields. The reasons for non-adoption of Azospirillum was lack of knowledge about the seed treatment and non-availability to purchase at the time of sowing. Weedicide and pheromone sex trap were not used by majority of the farmers due to lack of knowledge.

**Meti and Hanchinal (1995)** reported lack of availability of good variety seed (97.50%), heavy expenditure (95.83%), lack of awareness (92.50%), lack of finance (85.83%), uncertainty of rains at right time of sowing (83.33%) for non-adoption of improved cotton technology.

**Desai et al. (2000)** reported lack of knowledge was major constraint in adoption of rainfed cotton practices.
Kher (1991) reported that in case of maize the problem in adoption were: non-availability of seed at proper time, lack of knowledge for use of correct seed rate, topography of land for line sowing, high cost and poor economic status for chemical fertilizer and lack of knowledge, non-availability of fungicide, insecticide and lack of technical guidance for plant protection.

Singh (1999) reported non-availability of high yielding varieties at proper time was the main constraint in adoption of high yielding variety of moth bean crop (84%); poor knowledge was the main constraint (88.75%) followed by high cost (61.25%), non-availability of pesticide (35%) and lack of money (21.25%) in adoption of seed treatment; lack of knowledge (55%) in adoption of recommended seed rate and lack of moisture (45%), lack of knowledge (37.50%) and lack of sowing implement (25%) in adoption of timely sowing of moth bean.

Jagdale and Nimbalkar (1993) reported that large proportion of respondents in small, medium and large farmers group had medium constraint level in adoption of improved dry land technology in sorghum.

Gowda and Lakshminarayan (2001) reported problem in adoption of groundnut farmers. Majority of non-adopter in both big and small farmers expressed lack of technical know-how, loss of cultivable areas and finance for construction of small section bund, land smoothening and leveling and opening of dead furrow, non-availability of implements during season and initial cost were the main reason for non-adoption of improved implement; non-availability of implement and lack of finance were the problems for use of seed cum fertilizer drill; non-availability and lack of finances were reasons for non-adoption of FYM; cent percent of both big and small farmers expressed that construction of farm pond was not necessary and not suitable for the area; regarding non-adoption of seed rate considerable percentage of both big and small farmers expressed non-availability of seed and finance; lack of
technical know-how was the reason for non-adoption of the recommended population of groundnut + redgram mixture and great majority of small farms and majority of big farmers expressed finance and lack of knowledge for non-adoption of plant protection measures.

Rao (1996) found that poor economic status of the farmers, lack of drought tolerant cultivars, inadequate and untimely supply of inputs and the poor contacts of the extension workers with farmers were problem in implementation of recommended moisture conservation practices.

Singh and Raj (1981) reported that when the new dry land farm technology was used at existing resource level capital shortage limits its full exploitation. Thus for full exploitation of the new dry land technology, provision of liberal credit facilities is a pre-requisite.

Bhople et al. (1991) reported that easy breakage of bunds constructed for checking of rain water and soil conservation were the major constraints reported by 87.20 percent farmers among situational constraint; sowing and cultivation of crops across slope is cumbersome reported by more than 60 percent farmers among the technical constraints and inadequate capital, non-availability of credit, costly nature of digging of farm pond and more investment in dry land technology was reported more than three-fourth of farmers under economic constraint.

Bhaskaram and Praveena (1982) reported that lack of knowledge and lack of guidance figured prominently as constraint in adoption of the improved dry land technology.

Jaiswal and Singh (1980) reported that majority of non-adopter did not apply chemical fertilizer largely on account of lack of money. Other reasons were risk involved due to uncertainty of rain, not habituated to apply chemical fertilizer for dry land crops, application of FYM and lack of response of fertilizer.
Shrivastava and Singh (1990) found three major constraints viz., high price of fertilizer, lack of irrigation facilities and erratic rainfall for paddy cultivation by all categories of cultivators.

Kumar and Singh (1991) reported that the marginal – small farmers and medium-big farmers did not consider equally the problems and suggestions about the chemical fertilizer consumptions.

Singh et al. (2000) reported that lack of irrigation facilities was the first constraint (81%), followed by high cost (67%), lack of knowledge (61%), lack of technical guidance (51%), non-availability of credit (34%), lack of finance (29%), low economic gain (27%) and non-availability of fertilizer in time(25%) in adoption of chemical fertilizer in arid area of Rajasthan.

Singh (1981) found that 30 per cent small farmers did not possess bullock in Dhone Block of Kumool district. They borrowed it from the big farmers when their work was completed. They also worked on other field as wage labour. Both these factors undermined the timeliness and quality of their agriculture operation.

**Impact of improved dry land technology**

Gowda and Jayaramaiah (1990) reported that socio-economic status, land productivity and annual income of the small and marginal farmers increased to a considerable extent as a result of the implementation of the watershed development programme.

Bhaskaram and Praveena (1982) found that there was significant difference in knowledge and adoption level between the farmers in the experimental group and control group with respect to improved dry land technology.
Saxena et al. (1990) reported that the farmers who adopted the various recommended practices of tanker wheat technology harvested an average yield of 13.07 to 17.60 q/ha and those who did not adopt the improved practices obtained an average yield of 5.40 to 9.87 q/ha.

Singh (1990) reported that due to effective extension in watershed area the cropping intensity increased from 84.28 percent in 1984-85 to 173.90 percent in 1989-90 and there was an increase of productivity ranging from 21.40 percent (pigeonpea) to 245.80 percent (wheat) in five years.

Choudhary (1991) reported that the ratio of production (yield/ha) between average yield of national demonstration and national average areas was sorghum 3.79, rice 2.34, chickpea 2.11, pearl millet 1.98, maize 1.50, wheat 1.38 and groundnut 1.07. The ratio between highest national demonstration yield and national average yield of tanker varied from 8.47 in sorghum to 2.12 in mustard. The ratio of pearl millet, chickpea, maize, rice, wheat and groundnut were 5.40, 3.62, 3.56, 3.55, 2.80 and 2.85 respectively.

Narayan (1991) reported that dry farming project benefited the farmers as *kharif* cotton yield increased ranging from 21.70 percent to 59.40 percent.

Virmani (1991) reported mean grain yield about 4000 kg/ha in improved system as compared to about 600-800 kg/ha in the traditional system at watershed based experiment at ICRISAT, Hyderabad.

Prasad (1991) reported that it was possible to raise the productivity by two three times by conserving soil and almost 95 percent by rainfall in micro watershed by simple techniques of contour bunding, vegetative bund, half moon terracing and bench terracing on mild slope.
Venkateswarlu (1991) reported that yield of crops under experimental field and demonstration farmers field compared to the state average was high. The state average yield (kg/ha) was pearl millet 286, cluster bean 156 and moth bean 105 which was far below than yield of experiment field (pearl millet 840, cluster bean 694 and moth bean 447) and the demonstration on the farmers field (pearl millet 478, cluster bean 410 and moth bean 200).

Rastogi et al. (1991) reported that the average net returns on per rupee additional investment were greater than unity with recommended practices in all crops under intercropping system at different centers except pearl millet + pigeonpea at Solapur with Rs.0.65 and cotton + black gram at Kovilpatti with Rs.0.79. The economics of sequence system indicated maximum return on per rupee investment at Rs.3.75 under green gram – pigeonpea sequence at Akola, Rs.0.47 under cowpea + finger millet at Bangalore and Rs.2.50 under green gram + pearl millet crop rotation at Jodhpur. The economics of different system of planting indicated that additional net return on per rupee additional investment in case of pearl millet was Rs.9.55 with paired row system of planting at Jodhpur followed by Rs.4.98 in pearl millet with ridger seeder system at Hissar, Rs.6.92 in sorghum with wide row system at Hyderabad, Rs.8.65 in castor with square planting system at Hyderabad, Rs.2.74 in pearl millet with paired row system at Nagaur and Rs.2.57 in pearl millet with transplanting at Hissar.

Singh et al. (1995) reported that higher yield and monetary advantage were obtained from demonstration plot of green gram and moth bean than the control plot.

Patidar and Singh (1996) reported that the seed yield was higher in improved variety of moth bean and green gram than local varieties and the increase in yield was 50-60 percent in moth bean and 20-30 percent in green gram.
Reddy et al. (1989) evaluated the impact of adoption of improved dry land crop production techniques in the watershed area of the operational research project of Hyderabad from 1976 to 1983. Use of intercropping systems (which included sorghum or pearl millet with pigeon peas, and castor with various crops and as sole crop) increased over the period studied, with resulting benefits (also associated with the use of improved genotypes, fertilizing and weeding) in crop yields, cropping patterns and farmers’ income.

Vyas (1989) examined the farm size productivity relationship in dry land agriculture in Nagaur District, Rajasthan for three successive years (1977-80) by employing correlation and regression methods and reported that returns to scale in dry land agriculture were positive but predominantly of a very low order.

Input supply for dry land crops

Vijayaragavan et al. (1990) found that the dry land farmers did not face any major problems with the availability of chemical fertilizers and pesticides which were mainly supplied through private dealers. However, farmers faced considerable difficulty in the availability of improved seed of cotton and seed treatment.

Relevance of traditional dry land technology

Prasad and Singh (1990) found that many of traditional farming practices meet propriety of scientific rationality to a great extent.

Verma et al. (1988) reported that out of 26 practices identified, the scientist recommended discontinuance of only nine practice, favored continuation of ten practices and undecided for seven practices.

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