Dry land techniques for vegetable production in India—A review

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ABSTRACT

Dry farming is cultivation of crops in regions with annual rainfall less than 750 mm. Dry land farming techniques includes Water conservation, increase Water absorption, reducing the loss of soil moisture, bunding and terracing, contour bunding, mulching, intercropping, precision agriculture, use of drip irrigation facilities and use of growth regulators and chemicals. Choice of varieties is important. Varieties which have proven excellent in irrigated areas are generally unsuited for dry land conditions. Many attempts at dry land farming have failed, largely due to lack of recognition of the requirements for the variety selection. Variety requirements for dry farming are short-stemmed varieties with limited leaf surface minimize transpiration, deep, prolific root systems enhance moisture utilization and quick-maturing varieties are important in order that the crop may develop prior to the hottest and driest part of the year and mature before moisture supplies are completely exhausted. Even after utilizing all the available water resources, about 50% of the cultivable area will still depends on rains. Therefore, the agricultural scientists, policy makers and farmers should appropriately realize the magnitude of role that rainfed agriculture or dryland farming can play. Vegetable cultivation under rainfed condition is not much popular while comparing to other systems of cultivation. However, it solves the problem of rural poverty and malnutrition. Therefore, much concentration should be given for dry land rainfed vegetable farming by efficient adoption of techniques.

Key Words:- Dry land, Intercropping, Mulching, Vegetables.
issues haunting different agro-ecosystems across the country. For instance cereals dominated rain fed agro-ecosystems are not only monotonous in their cropping system but also failed to address nutritional requirement of the poor farmers and are less potential economically. Perhaps this might be the fact that, policy makers inclined to give thought on introduction of horticulture (vegetable) crops into the cereals dominated rain fed agro-ecosystems through National Agriculture Technology Project (NATP) bearing project number RNPS-22, so as to introduce the element of diversity into the land use system, besides, meeting nutritional requirement like vitamins and minerals etc; as vegetable crops are rich in vitamins, minerals and other nutritional components. Several vegetables viz., culsterbean, okra, onion and chilli are more economically potential than many of the cereals; hence part of the land can be covered with vegetables, so as to accomplish diversity in land use system. Moisture being the most limiting for growth and development in these lands needs to be conserved to the best advantage of crop plants. Sorkod and Ital (1998) have observed higher soil moisture content due to compartment bunding, while Selvaraju et al. (1999) reported similar views due to adoption of tied ridges and furrows and compartment bunding as compared to flat bed method. Conservation of in-situ moisture still holds more relevance in vegetables, which are less resistant to moisture deficit environment than traditional drought resistant agricultural crops. Hence, successful attempt was made to grow vegetables exclusively under dry lands with moisture conservation practices. The three primary ways to enhance dry land vegetable production through higher crop yields are:

1) To increase effective rainfall use through improved water management
2) To increase crop yields in dry land areas through agricultural research; and
3) To reform policies and increase investment in dry land areas.

**DRY LAND FARMING TECHNIQUES**

**Water Conversation:** Water conservation methods, often referred to as *in situ* rainwater harvesting, include activities such as mulching, deep tillage, contour farming and ridging (Habitu and Mahoo 1999). The purpose behind these methods is to ensure that the rainwater is held long enough on the cropped area to ensure infiltration. These techniques are best suited to areas where rainfall and water holding capacity are sufficient to meet the crop water requirement but the amount of water infiltration is not adequate to reach the required moisture level (Habitu and Mahoo 1999).

**2. Increase Water Absorption**

*Prevent a crust at the soil surface:*- Probably the greatest deterrent to a high rate of water absorption is the tendency for soils to puddle at the surface and form a seal or crust against water intake. The beating action of raindrops tends to break down clods and disperse the soil.

By tillage, create a rough, cloudy surface which lengthens the time necessary for the rain to break down the clods and seal the surface. For seed bed preparation in general, small seeds should have a finer, mellower bed than large seeds. After harvest, create a stubble mulch on the surface. Such material not only prevents raindrops from impinging directly on the soil, but impedes the flow of water down the slope, increasing absorption time.

**Reduce the runoff of water:**- To the extent that waterlogging is not a problem, the runoff of water and its attendant erosion must be stopped. Cropland should be as level as possible. All tillage and plantings must run across (or perpendicular to) the slope of the land. Such ridges will impede the downward movement of water.

**3. Reducing the Loss of Soil Moisture**

**Reducing soil evaporation:**- Water in the soil exists as a continuous film surrounding each grain. As water near the surface evaporates, water is drawn up from below to replace it, thinning the film. When it becomes too thin for plant roots to absorb, wilting occurs. Shelter belts of trees or shrubs reduce wind speeds and cast shadows which can reduce evaporation 10 to 30 percent by itself and also reduce wind erosion. Mulching reduces the surface speeds of wind and reduces soil temperatures. Tillage must be repeated afer each rain to restore the discontinuity. This is most workable where rainfall occurs in a few major rainfalls with relatively long intervals in between.

**Reducing transpiration:**- All growing plants extract water form the soil and evaporate it from their leaves and stems in a process known as transpiration. Transpiration is a process of water loss from the plant surface. About 99% of water absorbed by the roots is lost to the atmosphere as transpiration. Antitranspirants are used to conserve water which otherwise is lost through transpiration. Antitranspirants can be effective in two ways

- Through films that coat the leaf surface, and
- Chemicals that close the stomata. (Davenport et al., 1972)

Antitranspirants such as phenylmercuric acetate and certain alkenyl succinic acids act by inhibiting stomatal opening (Zelitch, 1965) Chemicals like Triadimefon, calcium chloride, fulvic acid, succinic acid are also used as antitranspirants (HU-Wengaung et al., 1995) Film forming antitranspirants (waxy or plastic emulsions) produce an external physical barrier to retard the escape of water vapour from plants (Gale, 1961)

- Weeds compete not only for soil nutrients, but water as well and so their control is critical.
- Selection of crop is significant as well. Dwarf varieties have less surface and so lose less water. Some plants close
their stomas when it is hot, reducing their water loss. Others, like corn, curl their leaves during hot afternoon and open them at night, effectively changing their surface area in response to conditions.

• Where rainfall is frequently marginal to insufficient, drought “insurance” can be obtained by clear fallowing a sufficient area. An area clear of growing vegetation with a properly maintained stubble and soil mulch can retain 20 to 70 percent of the precipitation received until the next year. Where 5 to 6 acres each year per family have been so set aside in India, the specter of famine due to drought has been eliminated.

• Post harvest tillage will create stubble and dirt mulches and destroy weeds before the onset of the dry season.

4. Bunding and Terracing

It is one of the important methods to conserve soil and moisture by creating earthen barriers in watersheds. The shape and size of bund will depend upon soil type, rainfall, amount of water to be stored, infiltration rate and tolerance of crop to be grown. Bunds in clayey soils may develop cracks. So one should be careful while planning for earthen bunds in black cotton soils.

5. Contour Bunding

In this earthen bunds are constructed on contours in gentle slopes ranging from 0.5 to 6 % with average annual rainfall not exceeding 750-1000mm. It is adopted on all types of relatively permeable soils except calayey or deep black cotton soils, where it may cause water stagnation and reduction of yields on upstream side. Contour bunded treatment recorded as low as 0.3 t/ha as soil loss when compared to 18.92 t/ha in control plots. (Kale et al., 1993)

6. Ridge and Furrow with mulch

It consists of forming furrows and beds across the slope before sowing. This is beneficial for moisture storage in soil profile while draining of excess runoff safely. This technique mostly used in soil moisture conservation in black cotton soils.

Allolli et al. (2008) reported that different moisture conservation practices viz., ridges and furrows, ridges and furrows + mulch and farmers practice (Flat bed method) were followed. Ridge and furrows along with mulch enhanced the vigour of the crop as manifested in higher plant height, leaf area and dry matter production. Further moisture conservation practices (ridges and furrow + mulch) helped to promote the productivity of cluster bean as evident in significantly higher yield per unit area. The pooled data indicated the higher yield (30.41 q/ha) due to ridges and furrows + mulch followed by ridges and furrows as compared to flat bed method (24.63 q/ha) of cultivation. The results of individual years followed the similar trend. The economic indicators like net returns per ha (Rs. 14701/ha) and B: C ratio (2.53) was found maximum with ridges and furrows + mulch. Further, ridges and furrows + mulch resulted in higher moisture retention in the soil as compared to flat bed method of cultivation.

7. Mulching

Mulching is spread of any material on soil surface. Mulching is an important agronomic measure that not only dissipates the kinetic energy of the rain drops and prevents soil erosion, but also facilitates infiltration and reduces runoff and evaporation losses (Krishnappa et al., 1999). Water easily enters porous soil and, as it seeps downward, becomes absorbed as films of water around the soil grains. These films form a continuous column of water to the surface of the soil. The film tends to remain the same thickness around all the soil grains with which it is in contact. This film of water in the soil is known as the capillary water and is the source of water for the plants. The sun, wind, and dry air will cause evaporation at the surface, thus reducing the thickness of the film at the surface. The thicker films in the subsoil will rise to equalize the distribution again. This will continue until the films are so thin that the plant roots can draw no further moisture from them. The result is drought.

Stubble mulching aims at disrupting the soil drying process by protecting the soil surface at all times, either with a growing crop or with crop residues left on the surface during fallows. To be effective, at least one ton per hectare must cover the surface, and the maximum benefit per unit residue is obtained at about two tons per hectare. Benefit may still be obtained at 8 tons per hectare. The first benefit of a stubble mulch is that wind speed is reduced at the surface by up to 99%, significantly reducing losses by evaporation. In addition, crop and weed residues can improve water penetration and decrease water runoff losses by a factor of 2 to 6 times and reduce wind and water erosion by factors of 4 to 8 relative to a bare fallow Field.

There are two limitations to the advantages of stubble mulch farming:

1. Dead surface vegetative matter can provide a home/breeding ground for plant diseases, insects or rodents. Use of a mulch not related to the succeeding crops will minimize much of the disease and insect effects. Use of stubble mulch only in the dry season will minimize all biological activity.

2. For decomposition, the ideal carbon to nitrogen ratio (C/N) is 25 to 30. Dry, woody, or non-green straw, stalks, etc. have a C/N of 50 to 100. This tends to slow decomposition and deplete soil nitrogen temporarily. Nitrogen is a major requirement for protein synthesis by plants. A stubble mulch during a biologically active period such as the rainy season, should only be used when either:

• Soil nitrogen is very high.

• Plant nitrogen needs are very low (such as cassava).

• A nitrogen-containing fertilizer is used.
To obtain the benefit of mulching on soil structure without causing temporary de-nitrification, the mulch can be composted before adding it to the soil. Rapid bacterial action in the tropics makes composting less beneficial than in temperate climates but may still be worthwhile.

**Dirt mulching** aims at disrupting the soil drying process with tillage techniques that separate the upper layer of the soil from the lower layers, making the soil moisture film discontinuous. In addition the soil surface is made more receptive to water intake. Principles of dirt mulching:

- Effectiveness increases with increasing depth to a limit of to 4 inches (75 to 100 mm).
- Increasing the dirt mulch depth decreases the available fertile soil.
- The effectiveness of dirt mulches decrease with age. Consequently it must be recreated by shallow tillage of harrowing after each rain or each month (whichever is more frequent).
- The crumb form of dirt mulch (particles greater than 1 mm) is more effective and resists wind erosion more than the dust form.
- Dirt mulches can only be properly made when the soil is moist.
- For a climate with a “rainy” growing season and a hot, windy, dry season, dirt mulching should only be performed during the rainy season and with a growing crop to slow the wind and water and hold the soil.

### 8. Intercropping

Intercropping should be a routine practice under dryland conditions for the purpose of making best use of soil and inter row moisture harvesting.

Pigeonpea (T-21, R-60) + radish (Pusa chetki): Two rows of radish are intercropped between paired rows of pigeonpea with set specification 30-90-30cm. Radish is harvested early within 40-50 days.

Pigeonpea (T-21, R-60) + Okra (Parbhani kranti): Two rows of okra are intercropped in between the paired rows of pigeonpea with set specification 30-90-30cm.

#### TABLE 1: Examples where natural enemies effected through Intercropping

<table>
<thead>
<tr>
<th>Agroecosystem</th>
<th>Natural enemies</th>
<th>Factor/Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorghum + cowpea</td>
<td>Ichneumonid parasitoid</td>
<td>High pupal mortality of pests</td>
</tr>
<tr>
<td>Chickpea + coriander</td>
<td>Larval parasites</td>
<td>Reduced pest due to more no. parasites</td>
</tr>
<tr>
<td>Cotton + clusterbean</td>
<td>Predators, Spiders, Coccinellids</td>
<td>More population</td>
</tr>
<tr>
<td>Cotton + cowpea</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Maize (Navjot) + cowpea (SEB-2): Two rows of low-trailing cowpeas are grown between paired rows of maize with set specification 30-90-30cm. Green pods of cowpea are harvested during 60-70 days after germination.

Maize (Navjot) + cowpea (SGL-1, Arka Kamal): Maize and non-trailing cowpeas are grown in 30cm apart uniform rows alternately. Green pods of cowpea are harvested within 50-60 days after germination. Green biomass of cowpea is used as mulch-cum-manure between rows of maize. Cowpea may be harvested for grain purpose at 70 days after germination.

Rice (ZHU 11-26) + Okra (Parbhani kranti): Four rows of rice in 15cm apart rows are grown in 75cm space between paired rows of okra with set specification 30 (okra) - 75 (rice) - 30cm (okra).

Yam (Hatikhoja) + maize (Navjot): The well-drained light textured soil of the zone is very congenial for tuber crops like yam. Yam is planted in mounds with row to row and plant to plant spacing of 90cm. Two rows of maize are planted in both sides of yam to act as live staking. Green cobs of maize are harvested at 75 days after crop emergence.

### TABLE 2: Examples of crop pest population management through Intercropping

<table>
<thead>
<tr>
<th>Agro-ecosystem</th>
<th>Pest</th>
<th>Factor/Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beans + maize</td>
<td>Empoasca krameri Ross and Moore</td>
<td>Reduction of pest incidence</td>
</tr>
<tr>
<td>Cowpea + sorghum</td>
<td>Ophiomyia phaseoli</td>
<td>Reduced and higher yields</td>
</tr>
<tr>
<td>Cowpea + maize, pepper and cassava</td>
<td>M. jostedi, Mylabris sp</td>
<td>Reduction of pests</td>
</tr>
<tr>
<td>Pigeonpea + coriander</td>
<td>H. armigera</td>
<td>Low incidence</td>
</tr>
</tbody>
</table>

(Shrinivasarao et al., 2002)

### 9. Precision agriculture

It has been used in the United States, has also been suggested for use in developing countries. Precision agriculture has had some success in the United States and other developed countries. While traditional agricultural techniques have tended to apply the same management to an entire field,
precision agriculture methods focus on information technology using site-specific soil, crop and other environmental data to determine specific inputs required for certain sections of a field. Many of these methods involve the use of technologies such as geographic information systems (GIS), satellites, and remote sensing. Precision agriculture can directly increase crop yields, and also improve water availability through greater relative infiltration of rainfall. In developing countries, the smaller farm sizes could allow for management on a field basis. Precision agriculture may hold significant promise in the future for agriculture in developing countries, as nutrient levels can vary greatly from field to field.

### 10. Use drip irrigation facilities

Using drip irrigation method, vegetables with very less quantity of water can be grown besides liquid fertilizers can effectively be added into irrigation water. In tomato, Dhake et al. (2009) reported that the yield contributing parameters were significantly higher under liquid fertilizer through drip irrigation than solid fertilizers applied through drip or surface irrigation.

### 11. Crop and Variety Selection

Choice of varieties is important. Varieties which have proven excellent in irrigated areas are generally unsuited for dry land conditions. Many attempts at dry land farming have failed, largely due to lack of recognition of the requirements for the variety selection.

Variety requirements for dry farming:
- Short-stemmed varieties with limited leaf surface minimize transpiration.
- Deep, prolific root systems enhance moisture utilization.
- Quick-maturing varieties are important in order that the crop may develop prior to the hottest and driest part of the year and mature before moisture supplies are completely exhausted (Table 3, 4).

#### Growth regulators and chemicals:

Exogenous applications of natural plant hormones as well as synthetic plant growth regulators are known to improve the fruit set, yield and accelerate uniform ripening for easy harvest under rainfed conditions. Mepiquat chloride is a bio-regulator which promotes the reproductive phase of vegetable crops. It imparts dark green colour to the leaves and shortens internodal length. Under moisture stress potassium protects the plant by involving in the exchange of cytoplasmic potassium for stomatal hydrogen ions thus raising stomatal pH and facilitating photosynthesis. This

### TABLE 3: Crops suitable for dry regions of the tropics

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Degree of Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citrullus lanatus</td>
<td>Watermelon</td>
<td>1</td>
</tr>
<tr>
<td>Cucurbita mixta</td>
<td>Mixta Squash</td>
<td>1.5</td>
</tr>
<tr>
<td>Abelomoschus esculentus</td>
<td>okra</td>
<td>1.5</td>
</tr>
<tr>
<td>Phaseolus vulgaris</td>
<td>Common Bean</td>
<td>1</td>
</tr>
<tr>
<td>Vigna Unguiculata</td>
<td>Cowpea</td>
<td>1.5</td>
</tr>
<tr>
<td>Manihot esculenta</td>
<td>Cassava</td>
<td>1</td>
</tr>
<tr>
<td>Dioscorea rotundata</td>
<td>White Yam</td>
<td>1</td>
</tr>
<tr>
<td>Sphenostylis stenocarpa</td>
<td>African Yam Bean</td>
<td>2</td>
</tr>
</tbody>
</table>

Creswell and Martin (1993)

### TABLE 4: Cultivars suitable for different regions in India

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Recommended region</th>
<th>Salient features</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGRI 2395 2</td>
<td>Uttar Pradesh (Bundelgurar 2)</td>
<td>Resistant to Xanthomonas and Alternaria, and its green forage yield is 25-45 t/ha</td>
</tr>
<tr>
<td>Guara 80</td>
<td>Punjab</td>
<td>Moderately resistant to bacterial leaf blight, and yields 35-40 t/ha</td>
</tr>
<tr>
<td>Bundel Guar 3</td>
<td>Arid, semi-arid zones (relatively drier areas with low to medium rainfall)</td>
<td>Fodder 50-55 days, green fodder 26.2-30.0 t/ha, dry matter 5.9-6.0 t/ha, seed 125-135days, seed yield 0.8-1.0 t/ha, fodder-cumgrain type, resistant to lodging, free from pod shattering, highly responsive to fer tilizers,moderately tolerant to drought, bacterial blight, and powdery mildew</td>
</tr>
<tr>
<td>RGC 1003, HGS 563</td>
<td>Arid tracts of all India</td>
<td>Yield 0.7 t/ha, maturity 90-100 days, 29.7% gum Synchrony in maturity, high gum content</td>
</tr>
<tr>
<td>HG 5563</td>
<td>Rainfed areas of Haryana, Rajasthan and Gujarat</td>
<td>Cow pea</td>
</tr>
<tr>
<td>UPC 8705</td>
<td>All India</td>
<td>Resistant to root-rot and collar-rot, yield 30-42 t/ha of green forage in 60 days</td>
</tr>
<tr>
<td>Haryana Lobia 88</td>
<td>Haryana</td>
<td>It is erect, suitable for intercropping with (CS 88) sorghum, pearl millet and maize and is resistant to yellow mosaic virus and yields 30 t/ha of green forage</td>
</tr>
<tr>
<td>Konkan (DFC 1)</td>
<td>Maharashtra</td>
<td>It is most suitable for high rainfall areas of Maharashtra; gives 30 tonnes of green forage/ha. This is fairly resistant to root rot</td>
</tr>
</tbody>
</table>

AICRPDA 2003
spray significantly reduces transpiration rate, this may be due to increased stomatal resistance, which lead to conservation of moisture in the cells by maintaining high relative water content. Proline accumulation was also higher in potassium chloride, which helps to channalise the diversion of protein metabolism for withstanding drought. Minimizing the transpiration losses by using anti-transpirants (Stomatal opening inhibitors viz., PMA, Alkenyl succinic acids and Atrazine at low concentration, Film forming substances viz., Mobi leaf, Hexadecanol and Silicones, Reflecting types viz., kaoline, celite), growth retardants (application of cycoceol reduces lodging and increases the yield) and wind breaks (Increasing the air resistance to water vapor).

**Tomato:** The most sensitive periods of tomato plants to moisture stress are the flowering and fruit enlargement stages. The desirable traits for rainfed varieties are reduced leaf area, production of more assimilates, high level of abscissic acid and increased fruit set. The maximum importance is given for osmotic adjustment and fruit set. Banerjee and Kalloo (1991) found that number of flowers per cluster was highest in Lycopersicon pimplinellifolium than other commercial cultivars of tomato under rainfed conditions.

**Brinjal:** Brinjal seeds pelleted with arappu and pungam leaf powders maintained its superiority in germinability than the untreated control even after eight months of storage (Viswanatha Reddy, 1995). In brinjal, application of potassium chloride at one per cent reduced the effect of drought by maintains high leaf number and leaf area leading to higher dry matter production through the better photosynthetic activity. Use of anti-transpirants increases the tolerance to moisture stress situations of brinjal. Prakash (1990) found that the diffusive resistance, relative water content and soluble protein were increased by spraying of cycoceol @ 500 ppm in brinjal.

**Chilli:** Chilli is one of the most important crops cultivated mainly under black soils of rainfed conditions. The states like Andhra Pradesh, Karnataka are major chilli growing areas under rainfed conditions. The gundu types are generally more pungent than samba types and they are adapted to rainfed culture than samba types. In chillies, the initial germination and subsequent seedling establishment and also the high mortality rate of the seedlings in the nursery are posing a great problem and seed pelleting as a pre-sowing treatment can enhance the seedlings and thus enhanced the yield can be obtained. Jerlin et al. (2008) reported that, Chilies cv.K1 has registered highest seed quality characters by using aluminium foil as a storage material and this was followed by 400 gauge polythene bag and cloth bag. Natarajan (1990) found that application of 75 kg nitrogen through soil and foliar sprays recorded the highest dry pod yield in chilli cv. Ramanathapuram Local under semidry conditions.

**Bhendi:** In bhendi, polythene mulch has recorded highest yield than control and grass mulch under moisture stress situations (Gupta and Gupta, 1985). Application of exfoliated vermiculite @ 20 t ha-1 increases the moisture retention capacity at 0.1 bar tension, decreases the bulk density and saturates the hydraulic conductivity of the soil and increases the yield of bhendi (Gupta and Gupta, 1982).

**Cucurbits:** Most of the cucurbits are planted in rainfed situation. In arid regions, curcurbit like xerophytic plants can absorb moisture from the atmosphere. Under lesser moisture conditions seed germination is very difficult process and affects the plant population. In case of musk melon the seeds are soaked in water over night and then kept in moist cloth or gunny bags in a warmer place and germination commences with in 3-4 days. Also, the seed water content declines rapidly 10 days after anthesis and 25 days later, the seed becomes tolerant to rapid desiccation. Singh et al. (1975) found that incorporation of bentonite alone or in combination with farm yard manure significantly increases the yield over other treatments in Cucumber. Pitcher irrigation is recommended for getting higher yield in bitter gourd grown under rainfed cultivation (Reddy and Rao, 1983).

**Leguminous vegetables:** Faba bean is grown as rabi crop in India under rainfed conditions. Cluster bean (Cyamopsis tetragonoloba) popularly known as guar is a drought hardy, deep rooted, summer annual legume, grown as vegetable. This crop is susceptible to water stagnation and as well as severe drought condition and hence the seed germination, emergence and establishment are very difficult under these conditions. In cluster bean cv. PUSII NAVBHAGAR, seeds coated with polykote @3g kg−1 along with bavistin @2g kg−1 maintained the seed germination and seedling vigour both initially and after accelerated ageing (Renugadevi et al., 2008). Application of 20 kg N, 60 kg P2O5 and 10 kg ZnSO4 recorded the highest number of pods per plant (Maliwal et al., 1987) in cluster beans.

**Agro horticulture:** Drumstick comes up well in all soils and can be grown even in waste lands. It is predominant crop of dry and arid tracts. Most fruit trees grown in dryland take 5-8 years to cover the interspaces. Further, in dry land fruit trees like ber, pruning is done every year, so, the interspace is available. In such cases, intercrops can be grown successfully and profitably between the fruit plants in a system of agro-horticulture. The crops grown in the interspaces should be normally low stature and of short duration, so that, they do not compete with the fruit trees for light, moisture and nutrients. At Hyderabad, agro horticulture system involving ber and vegetables resulted in higher returns than ber alone (Somani, 1992).
CONCLUSION
Even after utilizing all the available water resources, about 50% of our cultivable area will still depend on rains. Therefore, our agricultural scientists, policy makers and farmers should appropriately realize the magnitude of role that rainfed agriculture or dryland farming can play. Vegetable cultivation under rainfed conditions is not much popular while comparing to other systems of cultivation. However, it solves the problem of rural poverty and malnutrition. Therefore, much concentration should be given for rainfed vegetable farming by efficient adoption of techniques viz., selection of varieties, seed treatment practices, use of growth regulating substances and protection of crops from different harmful physiological or biological agencies.

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