

Novel water harnessing techniques:

Boon for quality apple introduction in Trans-Himalayas (Ladakh)

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Ladakh is a cold arid region of India. Owing to prolonged severe winter, this region has limited cropping season and cultivation of barley and vegetable is possible during summer (May-October) with apple and apricot as main fruit crops. As scanty rainfall occurs, the region is known as cold desert. The main source of water in the region are glaciers which melt during summer and irrigate through canals linked with rivers. Cultivation is possible only near the river sites. Any crop in Ladakh can be grown with assured irrigation. Most part of the region is barren due to lack of water for irrigation. Therefore, efficient water management is very important aspect and several water harnessing aids like mulching, drip irrigation and hydrogel can play an important role for growing the crops in water scarce conditions.

Key words: Drip irrigation, Mulching, Water harvesting

INDIA RANKS 41st among 181 countries of the world with regard to water stress. More than 60% of the net cultivated area is under dry land condition. Also, more than 30% area faces the problem of insufficient rainfall. With context to Ladakh, water harnessing and moisture conservation should evolve together for a sustainable mountain environment. Water harnessing is the process of collecting and storing water from the specified areas. The water can be stored successfully in tanks, reservoirs and in the soils. The water is diverted from the watershed to the fields/crops. This practice is popular in many countries of the world particularly in the desert regions. These old systems of water storing are the pavements of modern water harnessing systems.

Introduction of quality apple variety saplings

Introduction of good apple varieties is a very important aspect. Under the study, three varieties namely Gala-Gala, Royal Delicious and Vance were introduced and

evaluated in the region with the guidance of scientists from Dr Y.S. Parmar University of Horticulture and Forestry, Solan, Himachal Pradesh. These varieties were planted at Army location in Military Station, Karu, Leh-Ladakh. The apple saplings were procured in dormant stage from Dr Y.S. Parmar University of Horticulture and Forestry, Solan, Himachal Pradesh. The saplings were transported by Airforce aircraft from Chandigarh to Leh in last week of January. The sapling could not be transplanted directly in the field due to unfavorable weather conditions (low temperature) in the month of February and March. Therefore, saplings were transplanted in polybags of 8-10 cm diameter and 18- 20 cm length dimension before breaking of dormancy in March. Well decomposed farmyard manure and fertile soil was used for polythene filling and 2–3 cm space was left from above. In previous study, very less (30%) survivability was recorded in directly planted saplings just after transportation. Therefore, this technique for introduction of saplings

had been standardized and more than 85% survivability was achieved.

Three different scions were used on crab apple rootstock namely Vance, Royal delicious and Gala-Gala. Crab apple (*Malus baccata*) is used as a rootstock. Its fruits are not very important as very sour due to malic acid but can be used as good rootstock for cold hardiness as these are being used it in Leh, Ladakh region.

Why water harnessing

Ladakh region of India is a cold arid desert on high altitudes with scarce water resources, high evapotranspirational losses, harsh dry winds, and totality of climatic conditions harsh and tough, hindering the agriculture. The annual precipitation is between 100 to 150 mm, quite inadequate to meet the average moisture requirements of the crop plants. Thus, supplementary irrigation becomes essential to raise food crops. The only source of available irrigation water are the glaciers placed on high altitudes which melt and flow during summer



Nursery maintenance at trial field



Plantation with mulching

season. This available natural resource needs scientific management strategy to ensure sustainable and economic crop production.

Concern of huge deployed army in Ladakh, is that large amount of water is required for watering army unit gardens or ornamental plants. Army distributes water through bowsers by flooding method due to which gallons of water is wasted. For 'per drop more crop', quality parameters and doubling farmers income, water efficiency is very important.

Keeping this water management concept, DIHAR, DRDO conducted an experiment in which drip irrigation was combined with mulching and hydrogel to observe plant morphological parameters.

Mulching

Mulching, the process of covering soil surface to create congenial conditions for the crop growth, may include moisture conservation, temperature moderation, weed control etc. Plastic mulches directly impact the microclimate around the plant by modifying the radiation budget (absorptivity vs. reflectivity) of the surface and decreasing the soil water loss. The colour of mulch largely determines its energy-radiating behavior and its influence on the microclimate around a plant. Black plastic mulch has been extensively studied at DIHAR for vegetable production. Soil temperature under black plastic mulch during the day time is generally 2–5°C higher at 10 cm depth compared to that of non-

mulched soil in summer. Black polyethylene 150 gauge thick was found very beneficial for the fruit crops. Mulching technology offers high return on investment besides saving 20–30% water. Various morphological characters which are fruitful for apple plant reproductive growth were found suitable with black polythene mulching for all three varieties and best suited for Royal delicious variety.

Drip irrigation

Water savings with drip irrigation system amounts to as much as 70% compared to flood irrigation system. Since the drip system is in the field at all times and is easy to operate, it can be turned on whenever the plants need water. When drip irrigation is used with plastic mulch, significant yield increase was observed. Use of drip irrigation system in open field is restricted to winter. Due to sub-zero temperature in winter, water in the drip piping system needs to be completely drained out before onset of winter. Failure to drain out water from the pipes often results in breakage of the laterals. Pipeline

joints are unlocked after every 50–60 ft in October to completely drain out the water and to prevent breakage of pipeline system due to contraction and expansion. The pipelines are joined again in April to make the system operational for irrigation. The system is connected to main water supply tank. The natural geographical gradient, which is common all over Ladakh, has been used to maintain the tank above the irrigation field level. The difference in height of the tank and that of the irrigation field allow water to flow at the desired pressure.

With reference to this, in Karu (Army Unit) main water reservoir source used is Sindhu river and drip irrigation is installed. Drippers are placed equidistantly and plant to plant distance is maintained at 4×4 m and row to row distance is 5×5 m

Hydrogel concept

Hydrogels are cross-linked polymers with a hydrophilic group which have the capacity to absorb large quantities of water without dissolving in water.

1. It can save irrigation water and

Table 1. Morphological parameters of apple with combination of black poly thene mulching , hydrogel and drip irrigation

Characters	V ₁ (Vance)	V ₂ (Gala-Gala)	V ₃ (Royal delicious)
Plant height (cm)	94.60	100	97
Shoot diameter (mm)	8.40	8.38	8.97
Leaf thickness (mm)	0.45	0.40	0.52
Leaf length (cm)	3.98	3.78	4.50
Leaf width (cm)	2.64	2.47	3.75
Leaf area (cm ²)	6.45	6.50	7.85
No. of Leaves	74	78	105
No. of Branches	9	11	16



Drip Irrigation in plantation field



Pusa Hydrogel

have used 60g hydrogel dose per plant while transplantation.

Data given in Table 1 revealed that with combination of black polythene mulching, hydrogel (60 g) and drip irrigation saved maximum water with good morphological growth.

SUMMARY

Using water harnessing techniques as mulching, drip irrigation and hydrogel, improved best suited morphological parameters. It will further improve future reproductive growth of the apple plant. This is the first experiment conducted in Ladakh by improvising efficient management of water. It can be suggested that gallons of water wastage with army bowsers can be saved with these water harnessing techniques.

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| <ul style="list-style-type: none"> nutrients up to 40 to 60%. 2. It improves soil fertility and soil texture. 3. It performs well even at 50-60°C soil temperature. 4. It helps in better growth i.e. around 20% increase in performance. 5. Yield increase reported from 10-30%. — Desirable characteristics for applications in agriculture high absorption capacity in saline and hard water | <ul style="list-style-type: none"> conditions • Optimized absorbency under load (AUL) • Lowest soluble content and residual monomer • Low price high durability and stability in the swelling environment and during storage • gradual biodegradability without formation of toxic species • pH neutrality after swelling in water photo-stability • Re wetting capabilities • For Karu experimental trial, we |
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Cropping Season and Fertilizer Requirement

To ensure adequate availability of fertilizers, Department of Agriculture and Cooperation (DAC) assesses requirement of major fertilizers before each cropping seasons. The assessment is made based on requirements projected by State Governments/UTs, past consumption, weather conditions, targeted area, cropping pattern, area under irrigation etc.

Most ideally, fertilizer requirements should be assessed on the basis of nutrient needs of the crops and cropping systems in a particular area (block, district, and state) commensurable with existing nutrient deficiencies. This will ensure balanced fertilization and also ensure availability of needed fertilizers, in particular, secondary and micronutrients which very often farmers do not get at right time and right place. IFFCO has made soil testing service robust and performing to ensure adoption of site specific nutrient management. The Government has rightly initiated the scheme of soil health cards which will help farmers to know about soil health.

— Editor