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CROPPING SYSTEM FOR ARID RAINFED ECO-SYSTEM

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The Indian hot arid zone covers about 10% (32 million ha) of the country's total geographical area which is spread in the state of Rajasthan (61%), Gujarat (20%), Punjab & Haryana (9%), and Karnataka & Andhra Pradesh (10%). The production and life support system in this region are constrained by environmental limitations such as low precipitation (100-420 mm/year), high temperature (45^oC to 50^oC) during summers, high wind speed (30-40 km/hr), high evapo-transpiration (1500-2000 mm/year). Along with this the sandy soils of this region are poor in nutrients and low in water holding capacity. Thus, it is very poor and low yielding system that is stressed again due to ever increasing population of both human as well as livestock with over exploitation of natural resources. Although the local people have evolved suitable land use, management systems of farming, pastoralism and conservation of natural resources but increasing demands warrants again for scientific approach to conserve the eroding natural base including biodiversity as well as sustainability of production per unit area of land. The local survival system of crop production has proved inadequate and insufficient to fulfill the ever-increasing need of food and fodder. The major desert characteristics keeping in view the climate, landform, soil and water are given as under.

1. The climate although has a well defined monsoon season as compared to other dried zones of world but the region has very low and erratic rainfall, high temperature, high evapo-transpiration, high winds and solar radiations.
2. The area has rocky landforms with poor derbies and hence scarce vegetation with unconsolidated nature of deposits.
3. Soils are poor in moisture retentions, organic carbon and nitrogen but sufficient nutrient reserves are found to support the rainfed crops and natural vegetation.
4. Ground water is available only in pockets, very deep, and poor in quality of saline/sodic in nature with low discharge capacity.
5. In cropping and land use, the area has highly adopted crops with well-developed traditional farming systems with low acceptability of technological advancement.

Rainfed cropping is a gamble in arid tract of Rajasthan because of low and erratic rainfall and frequent occurrence of drought during crop growth period, occasionally leading to complete crop failure. In good rainfall years it provide a basis for security for food and fodder with the use of very minimum inputs. To avoid the complete crop failure the farmers are adopting mixed cropping from a very ancient time. But the system is not perfect during the adverse climatic situations due to adoption of old, low yielding, long duration traditional varieties and unmatched crop combinations. Therefore, in mixed or multicrop system the choice of drought hardy, short-duration varieties of crops is necessary to ensure the production of crops even under adverse situations. It has been seen that drought occurrence during the month of July and August leads to 67-100 percent decrease in production of pearl millet and short duration pulses which are the main crops of the region grown under rainfed condition.

Rainfed agriculture is, by definition, agriculture dependent upon the vagaries of weathers especially rainfall. Agricultural productivity and production in about 90 million ha of the country's dry land areas continue to depend on the quantum of rainfall and its special temporal variability. In spite of the increasing production trends of many dry land crops resulting from the adoption of improved technologies, inter annual fluctuations in production and productivity of these dry land crops continues to be a major obstacle in achieving sustainability in rainfed agriculture. The development and productivity of crops is the resultant effect of many physical and physiological processes each of which is affected individually or jointly, by weather parameters. The most important parameter are precipitation (periodicity and duration), air, soil temperature and radiation.

As per the arid zone characteristics moisture is main limiting factor which must be managed very judiciousally and carefully for sustainable crop production. The agro-ecology of the region demands modified practices in reference to the micro-environment that influences agriculture. Therefore, delineation of agro-ecological regions is very important which affects the agro-techniques of crop production and sustainability of cropping system. The agro-climatic zones of northwestern hot arid agro-ecosystem have been classified into three major parts (Table-1).

Table-1 : Classified zones as per different classification

As per planning commission	As per National Agricultural Technology Project
VI Trans gangatic plains	HR-2 Western Zone PB-4 Western plain Zone PB-5 Western zone
XIII Gujarat plain and Hill region	RJ-2 Canal irrigated north western zone GJ-5 North western zone Gj-4 North Saurashtra zone
XIV Western Dry Zone	RJ-1 Arid western Zone RJ-3 Transitional plain zone of inland drainage RJ-4 Transitional plain of Luni Basin

Source: Gupta *et al.*, 2000.

SOILS

Two third of Indian arid zone is made-up of Aeolian sands in form of sand dunes and sandy plains of varying degree of hummockness. The aeolian sediments are low in clay and silt