

Cultivation of Drought Resistant Species in Asian Countries

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Introduction

The Asia-Pacific region comprising 35 countries stretches east west from Iran to Cook Islands and north south from Mongolia to New Zealand. The Indian Ocean provides moisture for the summer monsoon over the southwestern area, while the China Sea, Gulf of Siam and Bay of Bengal are the main sources of water for the winter monsoon, which affects the northeastern region. Northwest India and much of Pakistan are extremely dry and receive limited rainfall annually. The desert and semi-arid conditions found here are in marked contrast to the tropical areas of coastal India, Sri Lanka and Bangladesh where annual rainfalls range from 1,000 to 2,000 mm. The wettest terrain is found in Southeast Asia and the Pacific region where rains are abundant. On a national basis, most Asian countries receive an annual rainfall of between 1,000 and 4,000 mm. Its seasonal pattern can be classified into (i) a single rainy season, (ii) two rainy seasons, and (iii) uniform seasonal rain with no distinct wet season.

The population engaged in agriculture in the Asia and Pacific countries varies from 50 per cent in Malaysia to 94 per cent in Nepal (ADB, 1996). Traditional agricultural practices continue to dominate in most countries. Widespread droughts and floods have caused severe crop failures leading to strained economies, abnormal food shortages, and at times famine (Table 1). The annual increase in human and livestock population further adds to the agricultural problems. rice cultivation followed by wheat (irrigated) is the main cropping system. Rice, maize, millet, sorghum, cotton, pulses, oilseeds, rubber, oil palm, coffee, sugarcane, fruits, and vegetables are major crop grown in this area.

Drought

Drought is defined as “prolonged dry weather, in a meteorological term a rainfall deficit expressed on a long term basis. Drought is generally

acknowledging as a normal feature of any climate associated with scarcity of water. OR

An adverse moisture index or adverse water balance due to prolonged dry spell or insufficient rainfall.

Aggravating factors:

- Excess evapotranspiration
- High Temp.
- Low moisture conservation capacity of soils.

Manmade factors-overexploitation of water resources, mismanagement of water

Classification of Drought

Meteorological drought: Drought as a situation when the seasonal rainfall over the area is less than 75% of its long term average.

Hydrological drought: Prolonged meteorological drought can result in hydrological drought with marked depletion of surface water and consequent drying up of reservoirs, lakes, decline in flow of streams and rivers as also fall in ground water table.

Agriculture drought: When soil moisture and rainfall are inadequate during the growing season to support a healthy crop growth till maturity causing extreme crop stress and drastic reduction in yields.

Socio-economic drought: Where water shortage ultimately adversely affects the economy of the region

Based on historical records, Jaiswal and Kolte (1981) reported 120 drought or famine-like incidences in various parts of the country between 1291 and 1979. During the 20th century alone, droughts of various intensities were experienced over a span of 28 years in India (Venkateswarlu, 1997) (Table 1).

Only limited data on their occurrence between 1950 and 1980 are available for the Asia-Pacific region (Steyaert, *et. al.*, 1981) (Table 2).

This scenario in the Asia-Pacific region indicates that drought is a growing threat to the very fabric of its society and environment. Therefore, more efforts are required to concentrate on policy, infrastructure and technological issues that are related to this natural

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Table 1: Areas Most Vulnerable to Drought in the Asia-Pacific Region

Country	Vulnerable Regions
Pakistan	Baluchistan, Northwest Frontier, and Sind provinces
India	185 districts in the western and southern regions
Nepal	Hills and Terai region
Myanmar	Mandalay in the rain shadow dry zone of the Arkan mountains
Sri Lanka	Northern, eastern, and south-eastern regions
Thailand	Northern, north-eastern, and central regions
Malaysia	Eastern half of the State of Negri Sembilan and eastern quarter Of the State of Sabah
Indonesia	Southeast of Jogjakarta on Java island and Lombok in Nusa Tenggara
Vietnam	Northern provinces
Cambodia	Battambang, Prey Veng, and Svay Rieng provinces
Philippines	Ilocos and Cagayan valleys in Luzon island

Source: Steyaert, et. al. 1981.

Table 2: Frequency of Drought 1950-80 in the Asia-Pacific Region

Country	Drought Years
Pakistan	1958, 1965, 1966, 1967, 1968, 1975, 1979
India	1950, 1951, 1952, 1958, 1963, 1965, 1966, 1968, 1972, 1974, 1979
Nepal	1964, 1974, 1977, 1979
Bangladesh	1950, 1957, 1959, 1965, 1972, 1974, 1979
Myanmar	1954, 1957, 1960, 1963, 1966, 1972, 1977
Sri Lanka	1961, 1966, 1967, 1975, 1976, 1977, 1979
Thailand	1952, 1953, 1954, 1955, 1958, 1966, 1967, 1968, 1972, 1974, 1976, 1977, 1978, 1979
Malaysia	1958, 1959, 1961, 1963, 1972, 1973, 1974, 1975, 1976, 1977, 1978
Indonesia	1961, 1962, 1963, 1964, 1966, 1967, 1968, 1972, 1973, 1976, 1977, 1979
Vietnam	1957, 1963, 1966, 1976, 1977, 1979, 1980
Cambodia	1954, 1955, 1958, 1963, 1968, 1960, 1972, 1974, 1976, 1977, 1979
Laos	1954, 1976, 1979, 1980
Philippines	1957, 1958, 1968, 1969, 1972, 1977, 1978

Source: Steyaert, et. al. (1981).

calamity at national, regional and global levels, and they should involve both governmental and intergovernmental agencies. National agricultural research organizations, international institutions, non-governmental organizations (NGOs) and the private sector need to work together to achieve the goal of sustainable agriculture based on the most efficient use of available natural resources, i.e., land, water, and vegetation in an integrated manner and within a viable farming network.

Current farming systems and practices in drought-prone areas

A farming system comprises several components such as land, water, plants, inputs, livestock, equipment, credit, and marketing (Raman and Balaguru, 1992). Farming in the region is generally rainfed and on marginal land, and this is responsible

for the high risks experienced. Rather than depend on annual crops alone, it would be desirable to spread the risk by engaging in a wide range of farming activities including tree crops and livestock. In the upland areas of Asia, perennial tree crop agriculture such as fruit, paulownia, rubber, and white mulberry cultivation along with arable crops have been the traditional practice.

Major crops are wheat and maize, with smaller areas of rice, cotton, soybeans, sweet potato and rape - depending on local temperature and water conditions - as well as citrus and some temperate fruits. Livestock are important, particularly cattle, pigs and poultry.

Drought management strategy

Drought is a natural disaster with serious and long-term socio-economic implications. It is therefore vital to develop appropriate measures to overcome.

Table 3: Drought Resistent species

S. No.	Local Name	Botanical Name	Uses
1	Khejri/Sangri	<i>Prosopis cineraria</i>	Leaf as fodder, green pods as vegetable, Dry pods as fruit, lops & tops fuel, wood as minor timber and fuel, shed tree, nitrogen fixing tree
2	Kummat/Gum tree	<i>Acacia senegal</i>	Leaf fodder, seeds as vegetable, wood as fuel, gum
3	Rohira	<i>Tecomella undulata</i>	Leaf fodder, seeds as vegetable, wood as fuel, gum
4	Jaal/pillu	<i>Salvadora oleoides</i>	Leaves as cattle feed, fruits for human consumption. Seeds for non edible oil and cake for animals
5	Bordi	<i>Z . Rotundifolia</i>	Leaves as food, fruits for human consumption, round wood as poles thorns for fencing
6	Phog		Its charcoal is used to melt iron. its flowers, known
7	Baoni	<i>Acacia jacquemontii</i>	Traditional <u>medicinal uses</u> , including treatment of <u>snakebite</u> , <u>induction of abortion</u> , and for <u>chronic renal disease</u> This shrub also plays an important role in stabilizing the <u>sand dunes</u> of its native desert habitat. The wood is valuable as <u>firewood</u> because it produces a large amount of heat. The branches are used in construction of huts and fences and the sturdy roots are used as <u>rope</u> .
8	Ker	<i>Capparis decidua</i>	This is a useful plant in its marginal habitat. Its spicy fruits are used for preparing <u>vegetables</u> , <u>curry</u> and <u>fine pickles</u> . Can attract helpful <u>insectivores</u> ; The plant also is used in <u>folk medicine</u> and <u>herbalism</u> . <u>Capparis decidua can be used in landscape gardening, afforestation and reforestation</u> in semi desert and desert areas; It provides assistance against <u>soil erosion</u> .
9	Guggal	<i>Commiphora wightii</i>	In the <u>traditional medicine</u> have been for reducing <u>obesity</u> , as well as in the treatment of <u>rheumatoid arthritis</u> , <u>osteoarthritis</u> and <u>sciatica</u> . Has a <u>fragrance</u> similar to that of <u>myrrh</u> and is commonly used in <u>incense and perfumes</u> .
10	Khip	<i>Leptadenia pyrotechnica</i>	The plant is used in thatching huts. The pods of this shrub, known as <u>khimpoli</u> (ripe in the month of march which are of medicinal value and used as vegetables. The plant fiber is used for making ropes. The plant is browsed by all stock, but especially by camels for which it is considered a good fodder
11	Bui	<i>Aerva javanica</i>	This <u>herb</u> is deep rooted, and is used as soil binder in desert reclamation. It is used for fuel and for fodder for goats. In traditional medicine this plant has many uses. It is used externally to remove swelling, relieve inflammation and promote healing of wounds and ulcers. The flowers and roots are used to alleviate kidney problems and rheumatism and the seeds are believed to cure headaches. A gargle is made from the plant to treat toothache.
12	Sania	<i>Crotalaria burhia</i>	It is a good soil binder and has medicinal value. It is used to make ropes and sheds for animals in the desert and also used to made <u>jhumpa</u> (desert huts). It is a food for goats.
13	Doob	<i>Cynodon dactylon</i>	It has a deep root system;in drought situations with penetrable soil, the root system can grow to over 2 m deep, though most of the root mass is less than 60 cm under the surface.
14	Sewan	<i>Cenchrus ciliaris</i>	
15	Dhaman	<i>Cenchrus setigerus</i>	

Farming systems in Asia and the Pacific are by and large complex and characterized by several environmental and socio-economic variables. Mixed farming - crop production and animal husbandry - for risk aversion, remains the mainstay of subsistence farmers. Hence, it is the only management strategy that is suitable for their adoption.

In order to do this, we need crops that are more efficient in the use of water and crops that can endure periods without water. There are many plants that are naturally tolerant to drought, and some, such as the resurrection plants, can even withstand total desiccation and recover completely after being watered again.

So, as we've seen, drought and water scarcity are serious threats for food security worldwide and we need drought-resistant crops mainly for rainfed regions, which are precisely the regions where food scarcity is higher and the communities are poorer.

Orans

Orans have social-cultural, ecological and economic significance to a great extent and are having a specific significance to ecosystem services for local communities, like provisioning (water, food, fuel wood, medicinal herbs etc.) and regulating (pollination and water purification etc). Being a vital repository of regional biodiversity, they even retain viable populations of rare and threatened species. Orans are also a source of multiple-use livelihood support system. They provide fuel wood and minor non-timber produce like edible fruits like Bordi (*Ziziphus nummularia*), Kair (*Capparis decidua*), Phogla from Phog (*Calligonum polygonoides* L.), Sangri from Khejri (*Prosopis cineraria*), Kumat (*Acacia senegal*), Khipoli from Kheep (*Leptadenia pyrotechnica*); gums and resins, honey, fibres, medicinal herbs etc. to the inhabitants. Gums from Acacias particularly from trees of Kumat (*A. senegal*) and shrubs of Bawli (*Acacia jacquemontii*) not only provide gum for their own consumption but also as livelihood support as additional income. *Ziziphus* shrubs/trees provide fresh as well as dry fruits to inhabitants. The Orans in Jaisalmer district with natural stands of Lana (*Haloxylon salicornicum*) are the source of wild mushroom locally called as Khumbi. Inhabitants of the area also generate income through collection of these produce and its sale in local market. The Bur grass (*Cymbopogon jwaruncusa*) is collected by the inhabitants for religious use and also for broom-making. Orans also provide habitat for water storage and nest-sites for wildlife and birds.

Drought-Resistant Species

Repeated droughts and soil degradation seriously endanger food security in many countries. Numerous studies are currently underway to select drought-resistant species. This research is not conducted only in laboratories and research stations: it is also based on close collaboration with rural communities. Indeed, they are the ones who test the new varieties and give the green light for further distribution of seeds.

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