Grass based cropping systems in arid and semi arid areas

N.D. Yadava

Agriculture in rainfed arid and semi arid both the conditions have high risk and crop failure is a common phenomenon. Unfavorable climatic factors coupled with biotic inferences have caused extensive damage to the arid ecosystem, which has affected human and animal of the region (table 1). Because the over increasing population rainfed and dry farming is being practiced on the land not suitable for cultivation. Ultimately the crop production has been shifted to or extended to the marginal and sub marginal lands resulting decimally low and highly unstable crop yields. The occurrence of drought again reduced the vegetation surface cover resulting high wind erosion and dust storms.

Soil erosion:

Wind erosion movement and deposition of sand is one of the most important factor for degradation of otherwise productive land. In India out of 175 million ha of degraded land, 60 million ha is affected by wind erosion alone. About 58 per cent of western Rajasthan is occupied by moving and semi stabilized sand dunes .The wind erosion is harmful because the areas where the soil removed and where it is deposited can loose their productivity. Grasses plays an important role in in arid zone production system being a perennial in nature (Gupta et al ,1994). The main problem of soil erosion through winds during cropping season as well as in fallow fields from February to June . The study has resulted that a soil loss of 1499 t/ha per season (April – June) occur only through wind erosion in a bare sandy soil of Bikaner (Table 1). In contrast there was no loss from pasture land and negligible loss of 22.5 t/ha from a crop land .The loss of 5560 t/ha soil from sand dune with out vegetative cover was enormously high (Gupta and Raina 1994).

Table 1: Sand drift under different land use conditions.

S.No.	Land use conditions	Sand drift (-)/deposition (+) (t/ha /season)
1	Bare sandy plain	-1449.0
2	Pasture land	+13.5
3	Crop land	-22.5
4	Bare sand dune	-5560.0
5	Sand dune with vegetative cover	+151.5

Source : Gupta & Raina ,1994)

Existing cropping systems:

The existing cropping pattern on rainfed lands of arid and semi arid lands are traditional and subsistence oriented. The traditional cropping systems of arid and semi arid areas include the drought tolerance crops of moth bean cluster bean and peal millet based cropping systems . It varies with the rainfall pattern of the region .In rainfed arid regions of western Rajasthan moth bean and cluster bean based cropping system is prevalent with the mixed cropping of Til and pearl millet. In hyper aric regions the cultivation of moth bean cluster bean and til is done in the fields dominated with the grasses like Sewan (*Lasiurus sindicus*) under rainfed condition. In semi arid areas where the rainfall (first week of July) the pearl millet based cropping system is followed with the mixed cropping of moth bean ,kakri / mateera etcBut the adversities like poor rainfall and non supply of canal water in time the farmers are shifting their cultivation towards less water requiring crops like: cluster bean and moth bean rather than going for cotton and groundnut in arid areas. These cropping systems are going to be very low production and non economical system

The uncertainty of rainfall sole cropping in the zone involve high risk therefore livestock based farming plays an important role in the economy of the arid and semiarid ecosystem. (Chaudhary *et a* 1993).Over exploitation of natural resources by increased biotic pressure, resulting scarcity of fodde and poor carrying capacity of pastures which is again a major constraint in increasing the productivit of animals. To over come these situations the exploitation of wasteland resources, development o eco-friendly techniques for improvement of natural pastures, development of legume and grass mixe pastures are the ways to increase the productivity of pastures. Thus under rainfed cropping thrus should be should be given to the grass production rather than going sole crop production in thes areas. Because the crop residues obtained from different crops are not sufficient to meet out th fodder requirement of the animals. Secondly the production zone of crops and grasses in rainfe

cropping is the same zone. The traditional practice of growing crops in between the existing Sewan grass clumps under mixed cropping system was an insurance of fodder production even also under adverse weather condition .The mechanization in agriculture ie sowing of crops by tractor the grass population from cultivated field are going to be disappear. In most of the areas the most prestigious grass Sewan *(Lasiurus sindicus)* has been completely eradicated. Now it is an urgent need for to develop a system suited for mechanized agriculture for placing the grasses through agronomic manipulations for these areas so that the Sewan and Dhaman or another indigenous grasses can grow for meeting out the fodder requirement of the animals under unfavorable circumstances. The another problem of soil erosion arises after the disappearance of the perennial grasses from cultivated fields. These adversities has reduced the over all fodder production from rainfed arid and semi arid areas. Therefore, it is an urgent need to include perennial grasses in crop production system. This will also reduce the soil erosion, maintaining the soil health resulting in stabilizing the production of crops and fodder.

Fodder production:

The increased fodder demand is one of the reasons of drastic reduction of indigenous grasses, shrubs and fodder trees from the areas. It has been estimated that in arid western Rajasthan during 1981 the fodder demand was 233.4 lakh tones whereas supply was only 195.83 lakh tones through all the sources Now the demand is more than this estimate (Table 2). The grass based cropping system is only a basis for supplement towards fulfilling the fodder deficiency.

Table 2: Demand and supply of fodder in different states.

S.No.	District	Demand (Lakh tones)	Supply (lakh tones)	
			Without crop residue	With crop residue
1	Rajasthan	233.02	23.83	172.00
2	Gujarat	100.63	25.00	139.90
3	Haryana	59.33	1.30	23.58

Grass based cropping system:

In arid and semi arid growing of field crops alone is not a stable enterprise because of risk involved due to drought and failure of rains during cropping season. In agriculture the integrated farming system approach (including animals) is only the successful enterprise in these regions. The perennial grasses of the region are the most compatible with the crops and farmers are growing their crops in the existing grass clumps from very bigning under mixed cropping system. It is proved that the grasses reduces the soil erosion and provide fodder for animals when crops are completely failed due to drought. The grass based cropping system is only the answer to rare the animals successfully with arable cropping under the mechanized farming situation. The Central Arid Zone Research Institute, Jodhpur has developed many technologies and studied their profitability as well as acceptability by the farmers The technologies which can able to reduce the maximum risk, conserve the environment and are economical along with easy to use can only be poplar in any reason. The few most appropriate grass based cropping systems are described as under.

1.Grass based strip-cropping system:

Desert grasses provide a permanent cover to the land surface with reducing the substantial reduction in wind erosion hazards during the kharif season under rainfed cropping and also in summers where there is no crop in the field (fallow). These grasses being in perennial in nature requires only one time sowing and sustained for 10 years or more. The strip cropping of grasses and crops provide an alternate land use system of agri-pasture that can give an insurance against complete crop failure during unfavorable weather conditions.

In strip cropping of crops with grasses, the grasses and crops are grown in different width of strips as per the soil characteristics and rainfall situation of the region. The protective strips of perennial grasses are grown in the strips at right angle s to the general directions of the prevailing winds. The different experiment conducted at Central Arid Zone Research Institute, Regional Research Station, Bikaner for more than 5 years with different grass strips of 3, 6 and 9 meter strips of grasses with a left space of 6,12, and 18 meter strips for cultivation of rainfed crops it was found that the strip ratio of 1:4 (3m: 12m) was found the most protective and productive system under Bikaner climatic situation. This system was found to be more economical in terms of yield and monetary benefits as well as checking the soil erosion up to a greater extent. The cluster bean crop grown in between the left strip produced1.04 q /ha more yield than their sole cropping.. The grass