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Land Suitability for Maize in Banswara District of Rajasthan

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Abstract

In this study an effort has been made to utilize the soils resource information of the area to evaluate soil suitability for maize cultivation. The area having an annual rainfall of 972 mm, soil depth 100 cm with gravelly sandy clay loam to clayey texture (10 to < 80% clay) and with a good drainage is most suitable for maize. Such area constitutes to near about 50 percent in the district of Banswara. Soils, with very shallow depth, having very high clay content, poor drainage or excessive slopes are appeared to be unsuitable.

Key words: Soil potential rating, soil suitability, maize, clay content.

Introduction

Soil survey, classification and mapping of soils helps in understanding the soil's potential and suitability for crop planning. Several workers have worked out the suitability of soils for various crops[1-4]. However, such information on soils of Banswara district of Rajasthan is very scanty and it is thus useful to evaluate the soils of this district for their suitability for maize cultivation.

Experimental

Banswara district has an area of 5067 sq. km. and occupies the southern most part of the state and lies between 23°10' to 23°31' N Latitude and 74°10' to 74°39' E Longitude. The climate is sub humid, subtropical and is characterized by hot and dry summers and cool winters. The mean temperature is 26.7°C. The MAST (Mean Average Soil Temperature) is 33.5°C MAWT (Mean Average Weather Temperature) is 20°C. The temperature regime is hyperthermic. The moisture regime is Ustic. Four dominant soil orders were mapped based on the physico-chemical and morphological characteristics. FAO methodology[5] for land evaluation was adopted to compute soil suitability classes such as: S1 - highly suitable - land having no significant limitation; S2 - moderately suitable - land having slight limitations causing moderate severity; S3 - marginally suitable - land having aggregation of severe limitations; N1 - currently not suitable - land having limitations which cannot be overcome at the current level of technology or at currently acceptable costs; N2- not suitable - having limitations which appear, so severe as to preclude any possibilities of successful sustained use of land in given manner. The characteristics and management requirements of maize for optimum production were identified based on important land qualities.

Results and Discussion

Land suitability relates land mapping unit (LMU) to the specific land utilization type (LUT). The important characteristics are presented in Table 1. Though the rainfall is quite high (972 mm), its distribution is erratic. The most of it is received during July and August. The potential evapotranspiration generally exceeds precipitation for most of the year except during the rainy season. The growing period is 100 days[6] thus restricting the choice of rain fed crops.

The specific land utilization type in the study area is annual cropping of maize (rain fed) for subsistence by small to marginal farmers with low capital resources, using mostly bullock drawn farm implements.

Land Use Requirement

In general, maize requires a freely drained, well aerated, deep soil (100 cm) without compaction and free salinity or alkalinity. Some of the selected requirements of soil and climate for maize[7] are shown in Table 2.

Land Quality Ratings

It is often difficult to have a direct measure of land qualities and in turn the land use. Table 1 shows the land quality rating for maize, which are based on threshold values of some important characteristics to maize. The ranges have been worked out from discussion with local agronomists and farmers of the area. Each mapping unit was matched with the requirement for maize and potential rating for each of the mapping unit allotted after considering the land qualities (Table 2).

Land Improvement and Potential Suitability

The mapping units (Table 2) which qualify as marginally suitable, suffer from the constraints like drainage and rooting depth and in few cases excessive slope. The management requirements for overcoming the problem of poor moisture retention (due to excessive drainage) includes incorporation of fine clay and silt from the lake floors or areas which have clay texture, straw mulching and higher doses of organic matter. Steeper lands could be

Table 1. Land quality ratings

Land use	Rating Index				
	S1	S2	S3	N1	N2
Available water					
AWC (mm/m)	150	100-150	75-100	50-75	50
Texture	C, Sic, Sicl, Si, Sil	Sl, Fs, Ls	Fs	S, Cs	S, Cs
Soil depth (cm)	100	50-75	20-50	20	20
Nutrient Status					
CEC (cmol p^+/kg soil)	12	8-12	8	-	-
OM (%)	0.8	0.4-0.8	0.4	-	-
Slope (%)	0-8	8-16	16-30	30-50	50
Drainage	well	Well imperfect	Poor S, Exe	Very poor	Very poor
pH	6.5-8.0	8.0-8.5	8.5	8.5	-

Texture- C = clay, Sic = silty clay, Sicl = silty clay loam, Sl = sandy loam, Fs = fine sand, Ls = loamy sand, Cs = coarse sand

Table 2. Suitability of different land units

Pedon	Rainfall (mm)	Drainage	Slope (%)	Texture	Soil depth (cm)	AWC (mm/profile)	$CaCO_3$	pH	OC	CEC	ESP
P_1	S_1	S_3	S_2	S_2	S_2	S_3	S_1	S_1	S_3	S_3	S_1
P_2	S_1	S_3	S_3	S_1	S_3	S_2	S_1	S_1	S_2	S_1	S_1
P_3	S_1	S_3	N_1	S_1	N_2	S_3	S_1	S_1	S_1	S_1	S_1
P_4	S_1	S_3	S_2	S_1	S_1	S_1	S_1	S_1	S_3	S_1	S_1
P_5	S_1	S_1	N_1	S_1	S_1	S_2	S_1	S_1	S_3	S_1	S_1
P_6	S_1	S_3	S_3	S_2	S_1	S_3	S_1	S_1	S_2	S_3	S_1
P_7	S_1	S_3	S_2	S_1	S_2	S_1	S_1	S_1	S_2	S_3	S_1
P_8	S_1	S_1	S_1	S_1	S_2	S_1	S_1	S_1	S_3	S_3	S_1
P_9	S_1	S_1	S_1	S_1	S_1	S_1	S_1	S_1	S_3	S_1	S_1

OC = Organic Carbon; CEC = Cation Exchange Capacity; ESP = Exchangeable Sodium Percentage

made suitable by constructing field bunds across the slope and planting maize across the slope to check erosion. By adopting this measure, the class S3 land may be brought to class S2 land.

The study reveals that the data collected during the soil resource surveys are useful to work out suitability of different soil units for specific crops or specific land use by comparing the requirements of the desired land use with the existing land qualities.

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