

## WATER AVAILABILITY AND CROP MANAGEMENT OF THE NELLORE DISTRICT, ANDHRA PRADESH, INDIA

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**ABSTRACT :** The Nellore district covering an area of about 13,160 km<sup>2</sup> in Andhra Pradesh has been studied with a view to bring out water availability days and calender. It has been found that in humid period there are 92 days, in wet period the number of days vary from 89 to 182 and in moderately dry period the days range from 91 to 184. Dry period is not noticed. The water availability calender reveals that humid and wet periods extend for about nine months in Krishnapatnam and Sullurpet (from July to March) and six months from September to February in other stations. Moderately dry period prevails for about six months in majority of the stations. Based on agroclimatic water availability days, Calender, Soil moisture, irrigation facilities and physical characteristics six crop suitability zones have been identified.

### INTRODUCTION :

Crop forecasting is an important task when the ecology of the crop production does not exactly fit into the climatological norms. The role of climate in agriculture is unpredictable due to gambling nature of the monsoons. Various climatic elements like rainfall, evapotranspiration, moisture adequacy, soil moisture, humidity, new and infrared radiation invariably affect crop production.

In agroclimatology the understanding of the above said parameters is essential for better crop management. Raman and Srinivasamurthy (1971), Subramanyam and Umadevi (1993), Sambasiva Rao (1985), Sambasiva Rao, et al., (1985) and Vasthala (1987) have made an attempt to study the water availability periods and crop management of the various regions in India.

### STUDY AREA :

The Nellore district covering an area of about 13,160 km<sup>2</sup> falls on the southern most coastal district of Andhra Pradesh and is located between 13° 30' to 15° 51' North latitude and 75° 5' to 80° 16' East longitude. The district is divided into 46 mandals and 1204 vaillages. The district enjoys dry sub-humid type of climate.

### OBJECTIVES :

The main objectives of this paper are;

1. to describe the water availability days in different periods,
2. to bring out the water availability calender of the Nellore district and
3. to prepare the crop suitability zones depending upon water availability days, calender, soil moisture conditions, irrigation and physical characteristics of the district.

## METHODOLOGY :

The water availability days during different months have been worked out based on Raman and Srinivasa Murthy (1971) method. The whole year has been divided into four periods namely, humid (where  $AE = PE$ ), wet (where  $AE = \frac{1}{2}$  of  $PE$  or less than  $\frac{1}{2}$  of  $PE$ ) moderately dry (where  $AE = \frac{1}{4}$  of the  $PE$  or less than  $\frac{1}{4}$  of the  $PE$ ) and dry (where  $AE = \frac{1}{8}$  of the  $PE$  or less than  $\frac{1}{8}$  of the  $PE$ ). Based on this method the number of days available during different periods have been worked out.

The water availability calendar has been prepared for each station in the district. Finally based on the water balance elements, soil moisture conditions, water availability days and periods, cropping patterns and irrigation, the crop suitability zones and crop management of the district has been discussed.

## WATER AVAILABILITY DAYS IN DIFFERENT PERIODS

### Humid Period : ( $AE=PE$ ) :

The number of days available in humid period are 92 in all the ten stations of the Nellore district (Table 1). The humid period extends from October to December in all the stations of the district. The north-east monsoon is very active over this district in the months of October, November and December. The depressions/cyclones formed in Bay of Bengal bring copious rainfall to the district. Therefore in the months of October, November and December the water availability is more in the district.

### Wet Period : ( $AE=1/2 PE$ ) :

The number of days in wet period varies from 89 to 182 days in the district. The minimum of 89 days are noticed in Nellore, Iskapalle, Atmakur, Gudur, Rapur, Udayagiri and Venkatagiri stations and the maximum of 182

days are found in Krishnapatnam and Sullurpet stations (Table 1). In Tada station only the number of days are 120.

The spatial distribution shows that in north-eastern and southern parts namely, Iskapalle, Atmakur, Gudur, Rapur, Udayagiri and Venkatagiri stations of the district the number of days available are less than 100. On south-eastern parts of the district in Krishnapatnam and Sullurpet stations the number of days in wet period exceeds 150 days. In south

**TABLE -1**

### Water availability Days in Different Periods of the Nellores District

| Station       | Humid | Wet | Moderately Dry | Dry |
|---------------|-------|-----|----------------|-----|
| Nellore       | 92    | 89  | 184            | .   |
| Iskapalle     | 92    | 89  | 184            | .   |
| Atmakur       | 92    | 89  | 184            | .   |
| Tada          | 92    | 120 | 153            | .   |
| Gudur         | 92    | 89  | 184            | .   |
| Rapur         | 92    | 89  | 184            | .   |
| Udayagiri     | 92    | 89  | 184            | .   |
| Krishnapatnam | 92    | 182 | 91             | .   |
| Sullurpet     | 92    | 182 | 91             | .   |
| Venkatagiri   | 92    | 89  | 184            | .   |

eastern parts the number of days vary from 100 to 150

### MODERATELY DRY PERIOD

#### ( $AE = 1/4 PE$ ) :

The number of days in moderately dry period vary from 91 to 184 days. The minimum of 91 days are found in Krishnapatnam and Sullurpet stations and the maximum of 184 days are noticed in Nellore, Iskapalle, Atmakur, Gudur,

Rapur, Udayagiri and Venkatagiri stations (Table-1). The spatial distribution shows that on south-eastern parts namely in Krishnapatnam and Sullurpet stations the number of days are less than 100. On north-eastern, south-western, central and southern parts the number of days has exceeded 175 and in the remaining parts of the district the number of days vary from 100 to 175 days.

In Krishnapatnam and Sullurpet stations the moderately dry period extends from April to June. In Nellore, Iskapalle, Atmakur, Gudur Rapur, Udayagiri and Venkatagiri stations the moderately dry period extends from March to August. On only Tada station the period extends

from April to August.

Dry period is not noticed in the Nellore District. In all the stations the number of days available in the dry period is nil.

#### WATER AVAILABILITY CALENDER:

Water availability calender depicts the duration of continuity of the different periods for proper planning and management of the crops. A break in the continuity of humid and wet periods is likely to affect the stages of growth of the crop and therefore an understanding of this calender is useful for crop management in a region (Table-2) Figure 1 gives an account of water availability calender of the Nellore

Table - 2

Water availability calender in Nellore District

| Station       | Humid          | Wet                                | Moderately Dry                      | Dry |
|---------------|----------------|------------------------------------|-------------------------------------|-----|
| Nellore       | Oct. Nov. Dec. | Jan, Feb, Sep.                     | Mar, April, May<br>June, July, Aug. | -   |
| Iskapalle     | Oct. Nov. Dec. | Jan, Feb, Sep.                     | Mar, April, May<br>June, July, Aug. | -   |
| Atmakur       | Oct, Nov. Dec. | Jan, Feb, Sep.                     | Mar, April, May<br>June, July, Aug. | -   |
| Tada          | Oct, Nov. Dec. | Jan, Feb, Sep.<br>Sep.             | Mar, April, May<br>June, July, Aug. | -   |
| Gudar         | Oct, Nov. Dec. | Jan, Feb, Sep.                     | Mar, April, May<br>June, July, Aug. | -   |
| Rapur         | Oct, Nov. Dec. | Jan, Feb, Sep.                     | Mar, April, May<br>June, July, Aug. | -   |
| Udayagiri     | Oct, Nov. Dec. | Jan, Feb, Sep.                     | Mar, April, May<br>June, July, Aug. | -   |
| Krishnapatnam | Oct, Nov. Dec. | Jan, Feb, March<br>July, Aug, Sep. | Mar, April, May                     | -   |
| Sullurpet     | Oct. Nov. Dec. | Jan, Feb, March<br>July, Aug, Sep. | Mar, April, May                     | -   |
| Venkatagiri   | Oct, Nov. Dec. | Jan, Feb, Sep.                     | Mar, April, May<br>June, July, Aug. | -   |

district. The humid period prevails for about three months in almost all the stations of the district and extends from october to December.

The wet period prevails for about three months in Nellore, Iskapalle, Atmakur, Gudur, Rapur, Udayagiri and Venkatagiri stations, four months in Tada station and six months in Krishnapatnam and Sullurpet stations. The wet period extends from January to February and September in Nellore, Iskapalle, Atmakur, Guder, Rapur, Udayagiri and Venkatagiri stations and in Tada stations the wet period extends from January to March and September. In Krishnapatnam and Sullurpet stations the wet period extends from January to March and July to September.

The wet and humid periods extend for about nine months in Krishnapatnam and Sullurpet staions, i.e. from July to March. In these two stations the crops could be cultivated in Kharif

and Rabi seasons. In Nellore, Iskapalle, Atmakur, Gudur, Rapur Udayagiri and Venkapagiri stations the wet and humid periods extend for about 6 months from September to February. Only one crop could be cultivated. In Tada station, the period extends for about 7 months from September to March. Two crops could be cultivated in Kharif and Rabi seasons.

The moderately dry period prevails for about three months from April to June in Krishnapatnam and Sullurpet stations.

It prevails from April to August for about five months in Tada station. In Nellore, Iskapalle, Atmakur, Gudur, Rapur, Udayagiri and Venkatagiri stations moderately dry period prevails from March to August for about six months. During this period crops could be cultivated only by supplementing with irrigation water (Table 2 and fig.1).

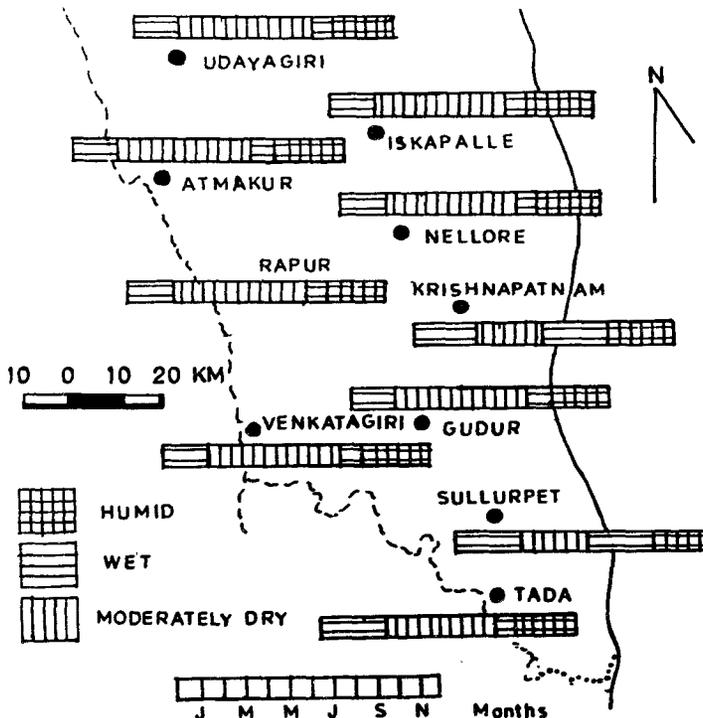


Fig. No. 1 : Water availability calender of the Nellore District

Dry period is not noticed in any one of stations of the Nellore District. From the study of water availability calendar it may be concluded that in Krishnapatnam and Sullurpet stations there is a prolonged wet and humid periods. Crops could be successfully cultivated in wet and humid period. However the moderately dry period extends for about five to six months in all the stations except in Krishnapatnam and Sullurpet where the duration of period is about three months.

### CROP SUITABILITY :

Based on agroclimatic, soil moisture

conditions, water availability, irrigation facilities and physical characteristics of the district the crop suitability has been discussed. Seven zones have been identified (Table 3) and (fig.2).

### ZONE - I

The zone - I consists of deltaic plains with slope less than one per cent. They are composed of rich alluvial soils deposited by river action. The source of irrigation is mainly canal, tank and well. The number of water availability days

Table -3

Crop Suitability of The nellore District

| Zone | land forms     | slope in degree | Source of irrigation | Soil condition         | water availability in humid and moist periods | Land Development   | Crop Recommended  |
|------|----------------|-----------------|----------------------|------------------------|---|--|---|
| 1    |                | 2               | 3                    | 4                      | 5   | 6  | 7   |
| I    | Deltaic plains | 1               | Canal & Well         | FERTILE Deltaic Soils  | 181   | Land levelling<br>Land mulching<br>Distillation &<br>Drain out of excess water | Paddy, Banana, Vegetables, Sugarcane, Oilseeds, Turmeric etc., Recommended for cultivation of Three Crops |
| II   | Fluvial        | 1               | Canal & Well         | Fertile Alluvial Soils | 181   | "  | Paddy, Banana Vegetables, Sugarcane, oilseeds, Turmeric etc., recommended for cultivation of Two Crops    |
| III  | Rolling plains | 3               | Canal & Well Tank    | Good Red Sandy soils   | 181   | propet water management practices, land forming smoothing & mulching           | Paddy, Dry food Crops, Vegetables, fruits & commercial Crops  |

|      | 1                                      | 2    | 3           | 4   | 5   | 6   | 7  |
|------|--|------|-------------|---|-----|---|--|
| IV   | Black Soils                            | 3    | Well & Tank | Deep and Sandy soils,                                 | 181 | Land levelling<br>Land shapping<br>Land forming &<br>Land mulching                        | Dry food crops<br>Oil Seeds &<br>Cereals   |
| V    | Lateritic Uplands                      | 3    | Well & Tank | Shallow Red Sands soils with exposure of barren rocks | 181 | Land grading<br>Land levelling<br>Land shaping &<br>Smoothing &<br>Land mulching          | Dry Food Crops<br>plantations and<br>Oil Seeds                                     |
| VI   | Coastal Sands                          | 1    | Well & Tank | Coastal sands Soils                                   |     | Land Levelling<br>Land Smootheing<br>Land mulching &<br>Disalinisation<br>terrace bunding | Paddy, Coastal<br>Plantations<br>Eculyptus,<br>Cashewnut<br>oilseeds &<br>Casurina |
| VII  | Undulating terrain with residual hills | 5-10 | Well & Tank | Deep and Shallow red Sandy soils                      | 181 | Land grading<br>Land terracing<br>Land mulching   | Plantations,<br>Dry food crops<br>pastures and<br>Horticulture Crops               |
| VIII | Hilly terrain                          | 20   | -           | Insitu soils  | 181 | Land terracing<br>Land levelling<br>Terrace bunding                                       | Natural<br>Forests   |

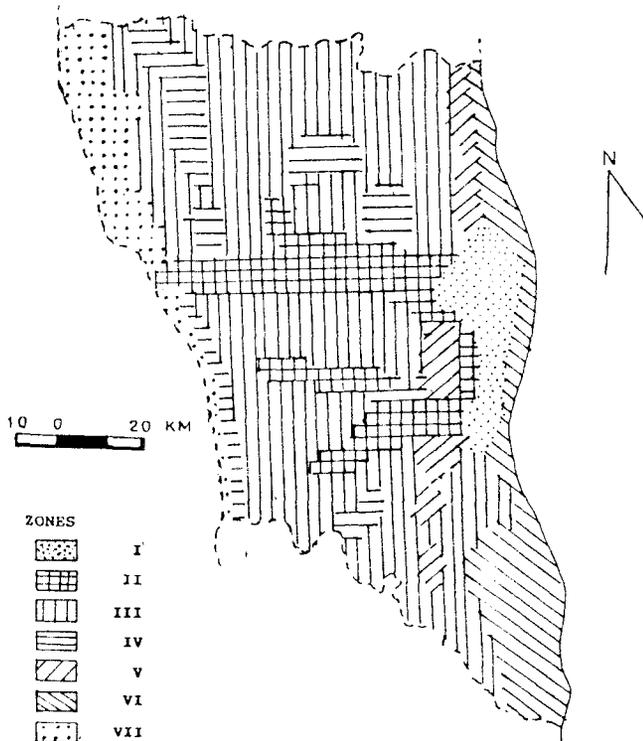


Fig. No. 2 : Crop suitability of the Nellore District

In humid and moist period are 181. The major land development activities that could be carried out are land levelling, land mulching, disiltation of drainage canals and tanks and draining out of water logged areas through under ground channels. The crops recommended in this class are paddy, banana, sugarcane, turmeric, vegetables and pulses. Two or three crops are recommended in Kharif and Rabi seasons depending upon source of irrigation.

### **ZONE- II**

The Zone - II constitutes the alluvial plains deposited on either side of the river valleys. The slope is less than one per cent. They are composed of rich alluvial soils deposited by river during peak flood periods. The major sources of irrigation are tank and well. Canal irrigation is also found in a few pockets. The number of water availability days in humid and moist period is 181. The major land development activities are land levelling, land mulching, dredging of tanks and draining out excess water from water logged areas through sub-terranean channels. The crops recommended are paddy, sugar-cane, turmeric, banana, pulses, vegetables and oilseeds. Two crops could be cultivated in Kharif and rabi seasons.

### **ZONE - III**

The Zone-III consists of rolling plains with deep red sandy soils. In a few pockets the major source of irrigation is canal. In majority of the plains the source of irrigation is well and tank. The slope is less than one per cent.

The number of water availability days present in the moist and humid periods are 181. The major land development activities are land shaping, land levelling, land farming and land mulching. The crops recommended for this zone are paddy in irrigated tanks, dry food

crops like ragi, jowar, bajra, oilseeds, chillies, onion and tobacco. Two crops are recommended under irrigation tanks and single crop under rainfed conditions from October to February.

### **ZONE - IV :**

The Zone - IV comprises of black soil plains. The slope is less one percent. They are sticky, rich black soils derived from in situ rock. The major source of irrigation is well or tank. The number of days available in moist and humid period are 181. The major land development activities are land shaping, land farming and land mulching. The crops recommended are cotton, dry food crops and oilseeds. Only one crop could be brought up under rainfed conditions and two crops under assured irrigation facilities.

### **ZONE - V:**

The Zone - V is composed of lateritic uplands. They are gravelliferous soils with slope less than 3 per cent. The soils are poor. Majority of these soils are left fallow. Scrubs and bushes have developed extensively. In a few pockets these lands are used for cultivation of cashewnut, casuriana, lemon and mango gardens. The land development activities are land grading, land levelling, land shaping, land smoothening, land mulching and removal of scrubs and bushes. The number of water availability days in humid and moist period are 181. The land is suitable for cultivation of dry food crops, and raising orchards like cashewnut, lemon and mango.

### **ZONE - VI :**

The Zone- VI consists of coastal plains lying parallel to the present shoreline. They are deposited by wave action. In a few pockets of the coastal plains marshes and mangroves have developed on alkaline clayey soils. The

ground water resources are poor and the slope is less than one per cent. The major source of irrigation is by canal or tank. The number of water availability days in humid and moist period are 181. Land development activities recommended are land levelling, land smoothening and land mulching. The crops recommended are paddy and groundnut in irrigated tracts, coastal plantations like casuriana, cashewnut, and coconut on the beach ridges and salt pans in reclaimed marsh and sandy areas. Prawn rearing is noticed in a few pockets of paleolagoons, reclaimed marshes and mangroves in the coastal tracts of the Nellore district.

#### **ZONE - VII:**

The Zone- VII is comprised of hilly terrain with rich and organic insitu soils. The slope is less than 20 per cent in the debris slope regions and more than 20 per cent in cliff regions. Land terracing, land levelling, and terrace bunding are the major land development activities. The number of water availability days present in the moist and humid periods are 181. Pastures, horticulture crops and forests of commercial value like firewood, soft wood,

bamboo bark, eucalyptus, pine, kusum teak etc., are recommended for this zone. Slope above 20 per cent should not be disturbed and should be used for the growth of natural forests.

#### **CONCLUSIONS :**

From the study of water availability days it is found in the district that the water availability days range from 181 to 274 in humid and wet periods. During moderately dry period the days vary from 91 to 184. Dry period is not noticed in any one of the stations. The water availability calendar reveals that in Krishnapatnam and Sullurpet stations there is a prolonged wet and humid period. The moderately dry period extends for about five to six months in all the stations except in Krishnapatnam and Sullurpet stations where the moderately dry period extends for about three months. Based on agroclimatic, soil moisture, water availability days and calendar, irrigation facilities and physical characteristics six crop suitability zones have been identified and depending upon their limitations crops are suggested for cultivation in each zone.

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