

Rainfall Analysis and Suggested Cropping System for Usilampatti Taluk of Madurai District, Tamil Nadu, India

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ABSTRACT

The rainfall data for the years (2013-2017) pertaining to Usilampatti Taluk of Madurai District were analysed for annual, seasonal, monthly and weekly periods and results are presented in this paper. The existing cropping system is discussed. Based on the rainfall pattern, a modified cropping system is suggested for effective utilization of land, moisture and nutrients and also to raise the income of dry land farmers.

Keywords: Rainfall analysis, Cropping system

INTRODUCTION

Water is vital for any life process and there can be no substitute for it. Water is also used for transportation, is a source of power and serves many other useful purposes for domestic consumption, agriculture and industry. The main important source of water in any area is rain and it has a dramatic effect on agriculture. Plants get their water supply from natural sources and through irrigation. The yield of crops particularly in rain-fed areas depends on the rainfall pattern, which makes it important to predict the probability of occurrence of rainfall from the past records of hydrological data using statistical analysis [1]. Rainfall is the primary source of soil moisture and this decides crop production particularly under semi-arid tropics. Many workers have reported suitable cropping pattern based on rainfall analysis of that particular area [2-4]. Such type of rainfall analysis was not done so far in respect of Usilampatti taluk of Madurai District. Hence, to suggest a suitable improved cropping pattern to Usilampatti Taluk, study on rainfall analysis was taken up.

This taluk is positioned at 9°97' N latitude and 77°8' E longitude with a mean elevation of 201 m. The climate of this place is semi-arid tropics with a mean rainfall of 696.5 mm. The maximum temperature ranges from 28°C to 39°C (maximum during May). The minimum temperature fluctuates between 16°C to 28°C (lowest during December and January). This taluk has got a total cultivable area of 13,762.3 ha against its geographical area of 37,417.3 ha.

MATERIALS AND METHODS

Data on recorded rainfall for 5 years from 2013 to 2017 were collected from the weather station, Usilampatty. The data were analysed as suggested by Kulandaivelue et al. [2]. The 75% probability rainfall was also worked out for annual, seasonal and monthly rainfall data.

RESULTS AND DISCUSSION

Annual rainfall

The mean annual rainfall of Usilampatty works to 696 mm received in 36 rainy days (**Table 1**). The maximum rainfall of 840 mm was recorded during 2015 while the minimum 354 mm of rainfall was obtained during 2016. The annual coefficient of variation of 43 per cent indicates the assured receipt of rainfall in every year in this taluk. At 75% probable rainfall, it worked to 840.7 mm.

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Table 1. Mean annual rainfall of Usilampatty (2013-2017).

| Year | Rainfall (mm) | Rainy days |
|------|---------------|------------|
| 2013 | 691.5 | 28 |
| 2014 | 818.5 | 49 |
| 2015 | 840.7 | 42 |
| 2016 | 354.9 | 16 |
| 2017 | 776.7 | 44 |

Average mean rainfall (mm): 696.5

Rainy days: 35.8

Coefficient of variation (%):43.9

75% Probable rainfall: 840.7 mm

Seasonal rainfall

The data on the distribution of rainfall for the four standard seasons indicate that contribution from north east Monsoon to the total rainfall was 43% (296.7 mm), followed by summer season (29%) (205.24 mm) and South West Monsoon had contributed (27%) (187.21 mm) and the rest by winter season (1%) (7.34 mm) (Table 2). Considering the CV for the four seasons, North East Monsoon stood first in

respect of assured rainfall followed by summer and south west monsoon (Figure 1). The contribution by winter was uncertain compared to north east monsoon. There is every year possibility of receiving assured rainfall at this tract during summer, north east monsoon and south west monsoon. This summer rains could be effectively used for summer ploughing under rainfed condition. The south west monsoon and north east monsoon rains should be used for raising dry crops.

Table 2. Mean seasonal rainfall of Usilampatty (2013-2017).

| Season | Mean rainfall (mm) | CV % |
|------------------------------|--------------------|--------|
| Winter (Jan-Feb) | 7.34 | 204.38 |
| Summer (Mar-May) | 205.24 | 65.08 |
| South west monsoon (Jun-Sep) | 187.21 | 49.59 |
| North east monsoon (Oct-Dec) | 296.70 | 21.84 |
| Total | 696.5 mm | |

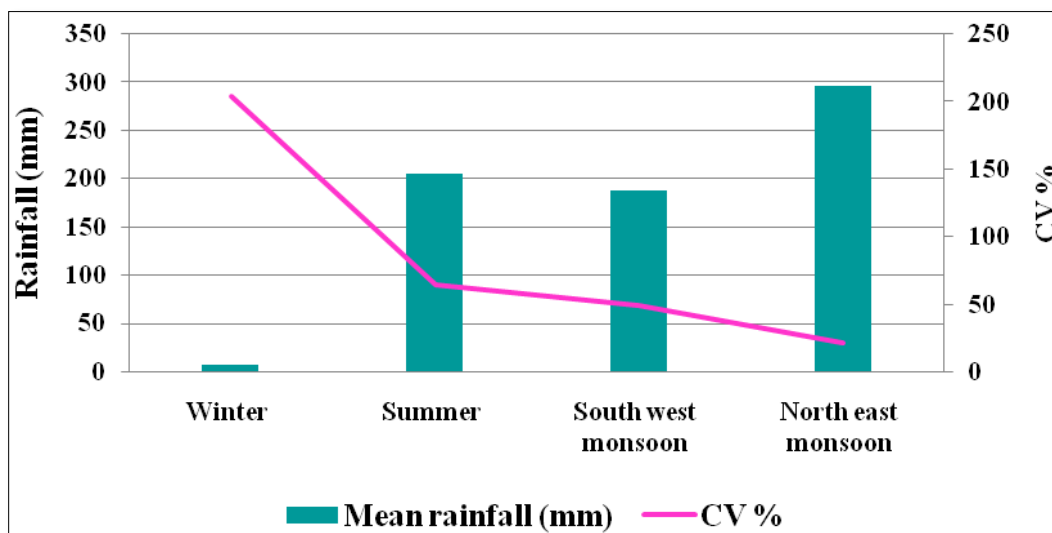


Figure 1. Mean seasonal rainfall (mm) Usilampatty (2013-2017).

Monthly rainfall

Among different months, October (202.3 mm) and May (95.06 mm) seem to receive the maximum rainfall followed by September (89.72 mm) and August (67.5 mm) (Figure 2). The period from March to May and August to November

could be considered as the best period for growing dry crops, because of the receipt of higher amount of rainfall accounting more than 50 mm per month (Table 3). This could be substantiated from the data on CV and 75% probable rainfall for these months.

Table 3. Mean annual and monthly rainfall of Usilampatty (2013-2017).

| Month | Mean rainfall (mm) | CV % |
|--------------|--------------------|--------|
| January | 0.52 | 223.61 |
| February | 6.82 | 223.61 |
| March | 66.08 | 75.10 |
| April | 44.10 | 158.14 |
| May | 95.06 | 83.55 |
| June | 19.96 | 128.05 |
| July | 10.02 | 164.24 |
| August | 67.50 | 79.83 |
| September | 89.72 | 69.58 |
| October | 202.33 | 55.14 |
| November | 62.56 | 117.03 |
| December | 31.82 | 68.55 |
| Total | 696.5 mm | |

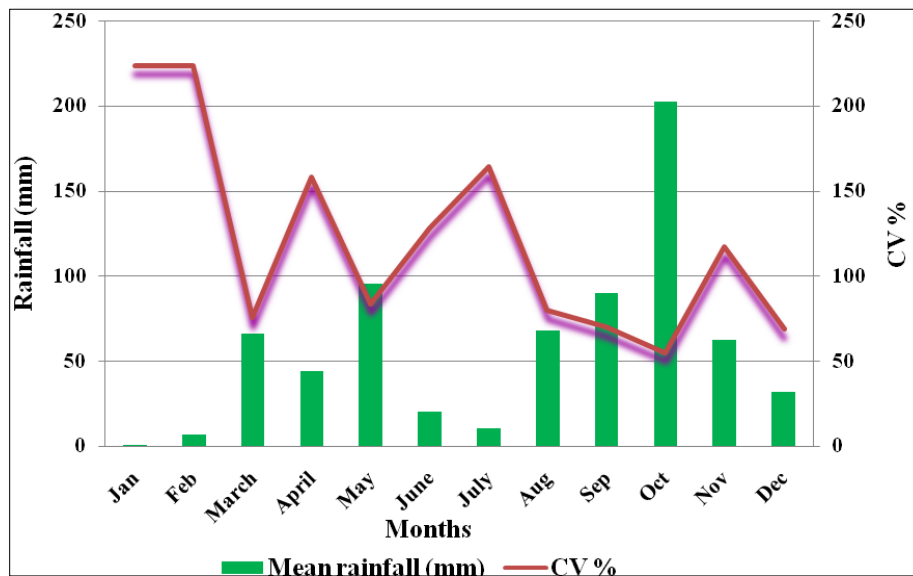


Figure 2. Mean annual and monthly rainfall (mm) and CV% Usilampatty (2013-2017).

Weekly rainfall

The weekly rainfall is more than 10 mm per week during the standard week 13, 14, 16, 17, 34, 35, 45, 46 and 47. The rainfall is more than 20 mm per week during 10, 11, 19, 20,

22, 31, 33, 36, 38, 39, 40, 41, 44 and 48. The rainfall was more than 50 mm per week during 42 and 43 Standard weeks. Highest rainfall of 62.42 mm was recorded by 42nd week (15-21 Oct) (Table 4).

Table 4. Mean weekly rainfall of Usilampatty (2013-2017).

| Standard week No. | Date | Rainfall (mm) | Rainy days | CV % |
|-------------------|---------------|---------------|------------|--------|
| 1 | 01 Jan-07 Jan | 0.00 | 0.00 | 0.00 |
| 2 | 08 Jan-14 Jan | 0.52 | 0.00 | 223.60 |
| 3 | 15 Jan-21 Jan | 0.00 | 0.00 | 0.00 |
| 4 | 22 Jan-28 Jan | 0.00 | 0.00 | 0.00 |
| 5 | 29 Jan-04 Feb | 0.00 | 0.00 | 0.00 |
| 6 | 05 Feb-11 Feb | 1.66 | 0.20 | 223.60 |
| 7 | 12 Feb-18 Feb | 5.16 | 0.20 | 223.60 |
| 8 | 19 Feb-25 Feb | 0.00 | 0.00 | 0.00 |
| 9 | 26 Feb-04 Mar | 4.46 | 0.20 | 223.60 |
| 10 | 05 Mar-11 Mar | 25.94 | 1.20 | 148.78 |
| 11 | 12 Mar-18 Mar | 21.42 | 0.40 | 182.72 |
| 12 | 19 Mar-25 Mar | 0.86 | 0.20 | 223.60 |
| 13 | 26 Mar-01 Apr | 13.40 | 0.20 | 223.60 |
| 14 | 02 Apr-08 Apr | 10.88 | 0.20 | 212.98 |
| 15 | 09 Apr-15 Apr | 3.78 | 0.40 | 165.30 |
| 16 | 16 Apr-22 Apr | 13.75 | 0.60 | 223.60 |
| 17 | 23 Apr-29 Apr | 15.69 | 1.40 | 79.20 |
| 18 | 30 Apr-06 May | 8.22 | 0.80 | 179.20 |
| 19 | 07 May-13 May | 27.89 | 1.80 | 122.73 |
| 20 | 14 May-20 May | 38.69 | 2.40 | 135.22 |
| 21 | 21 May-27 May | 2.34 | 0.40 | 158.62 |
| 22 | 28 May-03 Jun | 20.18 | 0.60 | 163.89 |
| 23 | 04 Jun-10 Jun | 8.44 | 0.40 | 180.79 |
| 24 | 11 Jun-17 Jun | 0.00 | 0.00 | 0.00 |
| 25 | 18 Jun-24 Jun | 0.00 | 0.00 | 0.00 |
| 26 | 25 Jun-01 Jul | 9.26 | 0.20 | 223.60 |
| 27 | 02 Jul-08 Jul | 0.00 | 0.00 | 0.00 |
| 28 | 09 Jul-15 Jul | 0.00 | 0.00 | 0.00 |
| 29 | 16 Jul-22 Jul | 0.00 | 0.00 | 0.00 |
| 30 | 23 Jul-29 Jul | 7.58 | 0.60 | 223.60 |
| 31 | 30 Jul-05 Aug | 24.34 | 0.80 | 138.32 |
| 32 | 06 Aug-12 Aug | 8.00 | 0.60 | 165.91 |
| 33 | 13 Aug-19 Aug | 25.36 | 1.20 | 94.63 |

| | | | | |
|--------------|---------------|-----------------|------|--------|
| 34 | 20 Aug-26 Aug | 10.14 | 0.40 | 134.88 |
| 35 | 27 Aug-02 Sep | 14.94 | 0.40 | 186.81 |
| 36 | 03 Sep-09 Sep | 26.82 | 1.40 | 110.65 |
| 37 | 10 Sep-16 Sep | 3.50 | 0.20 | 189.02 |
| 38 | 17 Sep-23 Sep | 25.32 | 0.40 | 210.18 |
| 39 | 24 Sep-30 Sep | 21.24 | 1.60 | 130.05 |
| 40 | 01 Oct-07 Oct | 26.93 | 1.20 | 118.44 |
| 41 | 08 Oct-14 Oct | 36.79 | 2.00 | 63.13 |
| 42 | 15 Oct-21 Oct | 62.42 | 1.80 | 169.68 |
| 43 | 22 Oct-28 Oct | 53.95 | 2.00 | 101.92 |
| 44 | 29 Oct-04 Nov | 32.36 | 1.40 | 103.53 |
| 45 | 05 Nov-11 Nov | 12.25 | 1.00 | 76.09 |
| 46 | 12 Nov-18 Nov | 11.84 | 1.40 | 119.03 |
| 47 | 19 Nov-25 Nov | 19.48 | 1.20 | 178.39 |
| 48 | 26 Nov-02 Dec | 28.15 | 1.40 | 127.59 |
| 49 | 03 Dec-09 Dec | 5.98 | 0.40 | 120.95 |
| 50 | 10 Dec-16 Dec | 3.66 | 0.40 | 130.51 |
| 51 | 17 Dec-23 Dec | 2.50 | 0.40 | 148.70 |
| 52 | 24 Dec-31 Dec | 0.40 | 0.00 | 223.60 |
| Total | | 696.5 mm | | |

An attempt was made to evolve a changed cropping pattern based on the rainfall analysis for this taluk so as to utilize the effective rains besides reducing the risk of cropping.

Presently, cropping pattern followed in this taluk is as follows.

Rainfed (double cropping)

Rice and pulses are the major crops sown under both pure and intercrop stand on receipt of rains during July. Farmers

choose to go for small millets and pulses if the South West Monsoon is extremely delayed. During normal years, farmers cultivate pulses, vegetables and Jasmine next to rice as a second crop (Table 5).

Table 5. Double cropping.

| | | | |
|----|---|----|---|
| 1. | Rice – Pulses (June-July) – (September-October) (100-150 days) – (80-85 days) | 2. | Small millets – Pulses (June-July) – (September-October) (90-95days) – (80-85 days) |
| | 3. | | |

Proposed Cropping System

Based on the analysis of rainfall, the existing cropping pattern is suitably modified in accordance with the quantum

and distribution of rainfall, length of growing period (LGP), gestation of crops, etc., the modified/proposed cropping system in accordance with early, normal and late onset of

South West Monsoon rains for Usilampatty taluk of Madurai district, Tamil Nadu is given below (Tables 6-8).

Table 6. Early rains.

| | | | |
|----|--|----|---|
| 1. | Cumbu – Ragi + Black gram – Gingelly (June) – (Sep-Oct) – (Dec-Jan) (95 days) – (105-110 days) – (85 days) | 2. | Groundnut – Gingelly/Black gram (June-Sep) – (Oct-Nov) (100-125 days) – (80-85days) |
|----|--|----|---|

Table 7. Normal rains.

| | | | |
|----|--|----|---|
| 1. | Gingelly – Black gram (June-Jul) – (Sep-Oct) (80-85 days) – (65-70 days) | 2. | Groundnut + Red gram – Ragi + Black gram (June-Sep) – (Oct-Nov) (100-125 days) – (105-110 days) |
|----|--|----|---|

Table 8. Late rains.

| | | | |
|----|--|----|---|
| 1. | Varagu – Gingelly (July-Aug) – (Oct-Nov) (100-120 days) – (80-90 days) | 2. | Cumbu – Gingelly (Sep-Oct) – (Dec-Jan) (95 days) – (80-85 days) |
|----|--|----|---|

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