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Assessment of onset, cessation of rain fall and length of growing period of different blocks of Dhenkanal district of Odisha for cultivation of winter pulses in rice fallow condition

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Abstract
Onset and cessation of rainfall and length of growing period of different blocks of Dhenkanal district of Odisha were assessed by analysing rainfall dataof 23 years (1995 to 2017). Date of onset and cessation of most of the block found to be 15-18thjune and 9-13th October. Start of the growing season begins with the onset of monsoon in between 14-18 June and end of the season happens in between 3-24 December in all blocks except Parajang in which there is early withdrawal of soil moisture in 30 November. The LGP is 170-180 days for most of the blocks and above 180 days for Dhenkanalsadar, Hindol and Kamakahyanagar.

Keywords: Onset, cessation, LGP, rice-fallow, pulses, SMW

Introduction
Length of growing season (LGP) is defined as the period, during which the moisture at the root zone of crop plants is adequate to meet the water need and also refers to number of days in a year during which rainfall plus moisture stored in the soil exceeds half of potential evapotranspiration. The spatial distribution of crops and farming systems in any region are determined by the LGP. In the district date of onset of effective monsoon was found to be 17th June and southwest monsoon generally ends on 10th October. Rice is the main crop grown rain fed thereafter the land is kept fallow during post monsoon which can be effectively utilized by cultivating pulses like green gram, black gram utilising residual soil moisture. For this the length of growing period is determined by timing and distribution of rainfall. Emphasis is given to adopt the suitable rice variety according to the LGP so that winter pulses can be grown in the rice fallow area so that their productive utilization can overcome many social and economic problems of the region like unemployment, labour migration and low income.

Materials and method
The study has been conducted for Dhenkanal district of Odisha which is located between 85°58´E to 86°20´E longitude and 20°29´N to 21°11´N latitudes comes under Mid Central Table Land Zone of Odisha having 8 number of blocks namely Bhuban, Dhenkanal sadar, Gondia, Kamakhyanagar, Hindol, Kanakadaahad, Parajang, Odapada. All the weather data like morning and evening relative humidity (RH_1, RH_2), bright sunshine hours (BSH), wind speed (WS) and evaporation (E) has been collected from the Department of Agricultural Meteorology, OUAT, BBSR for the period 1995-2017 (23 years). Daily rainfall data of each block were collected from Special Relief Commissioner (SRC), Government of Odisha for the same period. AWHC of soil data were collected from Department of Soil Science and Agricultural chemistry, OUAT, Bhubaneswar.
In the present study LGP was calculated through
LGP= [Duration of rainy season in days + Post monsoon and winter rainfall (mm)+ AWHC (mm/m) /average evaporative demand of the atmosphere per day from agricultural field in post-monsoon and winter season] (Sattar *et al.*, 2013) [9].
Average evaporative demand of the atmosphere in post monsoon and winter period from agricultural field in Dhenkanal was taken as 3.8 mm per day. As per soil characteristics, the available water holding capacity (AWHC) per one meter depth for Dhenkanalsadar and

Kamakhyanagar soils were 150 mm/m. The AWHC of Bhuban, Gondia, Hindol, Kankadahad, Odapada and Parajang soils were taken 100 mm/m.

Fig 1: District map of Dhenkanal

Normal value of daily rain fall

Normal value of daily rainfall of each block of Dhenkanal district was computed over the period of 23 years by the help of "Rainy day.exe" module of weather cock.

Computation method for onset and withdrawal of rainy season

The onset and withdrawal of rainy season was computed from mean daily rainfall data by forward and backward accumulation methods as per the procedure suggested by (Dash and Senapati 1992) [3]. Date of onset of monsoon determined by forward accumulation (May 28, 29, 30, 31….) when it is ≥75mm from May 28 (Panigrahi and Panda, 2002) and the date of cessation is determined by backward accumulation (Oct 15, 14, 13……..) when it is≥20mm from October 15 in the normal daily rainfall data. (Babu and Lakshminarayana, 1997; Srinivasa R *et al*., 2008) [1, 10].

Monsoon rainy days

The rainy day is calculated as the day from onset of monsoon to cessation of monsoon.

Post monsoon and winter Rainfall

Post-monsoon and winter rain fall consists of from the day after cessation of monsoon in October to February. It was calculated from the normal value of daily Rain fall data.

Result and discussion

Onset of monsoon in most of the blockswas during 17-18 June, but early onsetbefore 17th June was observed in Hindol, Kankadahad and Gondia. In most of the blocks cessation of monsoon was by 10-11 Oct. There were 115-120 rainy days during monsoon in most of the blocks with maximum (122 rainy days) in Hindol and minimum (113days) in Odapada block. Most of the blocks received 106-133mm post-monsoon and winter rainfall with minimum (99mm) in Parajang and maximum (165mm) in Hindol (Table 1) With the onset of monsoon in between 14-18June the growing season begins and end of the season happens in between 3-24Dec in all blocks except Parajang where there is early withdrawal of soil moisture by 30thNovember. The duration of growing season for most of the block was 25 weeks in soils having water holding 100 mm/m capacity (Table 2) except Hindol and Parajang where it was 27 and 24 weeks, respectively (Table 3) in medium land condition where midium duration (120days) rice variety like 'Lalat', 'Naveen' and 'Konark' were encouraged (Mazid *et al.*, 1997) [5]. These are harvested in 40-41 SMW thereafter short duration green gram variety IPM-02-03, PDM- 54 and black gram variety PU-31 are sown by zero till method (Chand *et al.*, 2011) [2]. The LGP was estimated 27 and 26 weeks(Table 3) in low land of Dhenkanal sadar and Kamakhyanagar respectively, having water holding capacity of 150mm/m (Table 2) soil where mid late duration rice variety like 'Swarna', 'Pratikhya' and 'Rani dhan' of 145days are encouraged and harvested in 42- 45 SMW followed by short duration green gram variety IPM-02-03,PDM- 54 and black gram variety PU-31 by *paira* method (Kushwana and Ali, 1992) [4]. The duration of growing season was the longest (27 weeks in Hindol and Dhenkanalsadar block and minimum (24weeks) in Parajang (Table). Similar results were found by Pasupalak (2015) [8].

Table 1: Block wise onset and cessation of rain fall, monsoon rainy day, post-monsoon and winter rainfall

Blocks	Onset of monsoon	Cessation of monsoon	Monsoon rainy days	Post monsoon and winter rainfall (mm)
Bhuban	17-Jun	9-Oct	115	123
Dhenkanalsadar	17-Jun	11-Oct	117	133
Gondia	15-Jun	10-Oct	118	118
Hindol	14-Jun	13-Oct	122	165
Kamakhyanagar	17-Jun	10-Oct	116	109
Kankadahad	14-Jun	10-Oct	119	106
Odapada	18-Jun	8-Oct	113	118
Parjang	18-Jun	10-Oct	115	99

Table 2: Block wise AWHC and average evaporative demand of soil per day

Blocks	AWHC (mm/m)	Average EVP (mm/day)
Bhuban	100	3.8
Dhenkanalsadar	150	3.8
Gondia	100	3.8
Hindol	100	3.8
Kamakhyanagar	150	3.8
Kankadahad	100	3.8
Odapada	100	3.8
Parjang	100	3.8

Table 3: Block wise Length of growing period (LGP)

Blocks	Start of growing season	End of growing season	LGP (days)	LGP (weekly)
Bhuban	17 June	7 Dec	174	25
Dhenkanalsadar	17 June	24 Dec	191	27
Gondia	15 June	9 Dec	178	25
Hindol	14 June	22 Dec	192	27
Kamakhyanagar	17 June	17 Dec	184	26
Kankadahad	14 June	3 Dec	173	25
Odapada	18June	6 Dec	172	25
Parjang	18 June	30 Nov	167	24
District mean			179	26

Summary and conclusion

This study reveals that there were 115-120 monsoon rainy days, so farmers may prefer short or mid duration rice variety in *kharif* followed by short duration winter pulses for better utilization of residual soil moisture in the rice-fallow. The LGP is 170-180 days for most of the blocks and above 180 days for Dhenkanalsadar, Hindol and Kamakahyanagar. There is maximum scope for utilization of residual soil moisture in those blocks by sowing of pulses in rice-fallow during 41-42 SMW in medium land by zero till method and 41-43 SMW in low land by *paira* method. This study further revealed that minimal irrigation is required for *rabi* pulses in Parajang during 48-49 SMW for early withdrawal of moisture and less availability of post-monsoon rainfall. However, suitable strategies for adjustment in sowing window of both *kharif* rice and *rabi* pulse crops could be a boon for enhancing the system productivity and profitability of the farming system under challenging rice-fallow condition.

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