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Crop growing period in Khordha district of Odisha

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Abstract

Khordha is an important coastal district of Odisha comprises of ten blocks which comes under East & South-eastern coastal plain agro-climatic zone. Agriculture plays a vital role in the economic development of the district. Agriculture in Khordha district is rainfed as well as irrigated however more area comes under rainfed as compared with irrigated. Hence, rainfall plays a dynamic role for crop production in the district. Growing season characterisation is an essential part of agriculture to identify the climatic risks and for a pragmatic crop planning. The determination of start, end and duration of growing season, and the pattern of dry spell during the season is useful information for the planning of land preparation and planting activities. The timing and distribution of rainfall determine both the length and quality of growing season. Using over 20 years of climatic data for Khordha District in Odisha, the study presents an analysis of growing season characteristics and other meteorological variables. Temperature is one of the limiting factor for both rainfed and irrigation based agriculture however in Indian context rainfall is more limiting for crop planning and productivity. The methods delaminates the growing season in the present study was based on rainfall, temperature and available soil moisture. Length of growing period (LGP) was calculated through a simple water balance model of FAO by taking weekly precipitation (PPT), potential evapotranspiration (PET) and available water holding capacity (AWHC) of soil. Soil moisture plays a big role in determining LGP in rainfed equal as break monsoon/dry period. The average growing season length in Khordha was 26 weeks at 50 mm soil water storage. Hence it was concluded that, more than one number of long duration crop (150 days) can't be grown without supplementary irrigation. So there is a need of reorientation of cropping pattern by taking a cereal crop of 120 days duration followed by a pulse crop of 60 days duration to exploited limited cropping system.

Keywords: Crop growing season, Length of growing period, PET, Soil moisture adequate

1. Introduction

Khordha receives an annual rainfall of 1463mm of which around 80% is received in SW monsoon season. Rainfall not temperature is limiting for crop production. Rice is the most dominant crop in this area. Beside paddy other major crops grown in the area are groundnut, black gram, green gram, horse gram, sugarcane and *Rabi* vegetables. Though Khordha gets ample rainfall in monsoon, seasonal drought occurs. So suitable duration is important which is to be matched with Length of Growing Season. There are six types of growing season out of which 3 types considered as "normal growing period" that prevails in Odisha. This is characterized by three distinguished periods with respect to rainfall into a dry period, a moist period and a wet period. Soil moisture plays a big role in determined LGP in rainfed equal as break monsoon/dry period. The characteristic of monsoon helps in deciding management practices so as to optimize seasonal weather and minimize rainfall risks and also water harvesting. LGP depends on two (a) Seasonal rainfall & (b) Soil moisture status. Rainfall includes both south-west monsoon & post monsoon. Soil moisture depends on soil depth and actual water holding capacity. Soil moisture is the key parental deciding in Soil-plant-atmosphere system. Soil moisture is very useful in estimating the water need and irrigation scheduling. Drought and flood occur frequently in Khordha district as well as in Odisha. Here the objective is to estimate the periods since the year of 1995 to 2014 when there has been sufficient moisture available for satisfactory crop growth in diff. blocks of Khordha district. Khordha receives monsoon rain from June to October and crop season is mainly confined this period under rainfed agriculture. Pre-monsoon rainfall is less and do not provide enough moisture to support a rainfed crop but it is important for land preparation and if done monsoon rainfall can be full advantageous. Crop growth and yield depends on soil moisture available during the crop season.

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Materials and Method

Khordha district is located between 19^o.55' to 20^o.25'N Latitude and 84^o.55' to 86^o.5'E Longitude. It comes under East & South-Eastern coastal plain agroclimatic zone and the zone blessed with sandy-loam, loam, clay-loam and clayey

soil in varied agro-eco system. The district has 10 blocks, namely, Baliana, Balipatna, Banapur, Begunia, Bhubaneswar, Bolagarh, Jatani, Chilika, Khordha and Jatani (Fig.1.0).



Fig 1: Block boundary of Khordha district (Source: mapsofindia.com)

Block wise daily rainfall data were collected from Special Relief Commissioner (SRC), Government of Odisha for the period from 1995 to 2014 and processed by using Statistical Analysis Software (SAS, 2014) [4]. Length of growing season (FAO,1978) was delaminated taking monthly rainfall and Potential Evapotranspiration (PET). As monsoon begins rainfall increases & PET decreases. The season starts when rainfall exceeds half of the PET. Length of growing period (FAO, 1978) was delaminated by taking monthly rainfall and Potential Evapotranspiration (PET). The season starts when rainfall exceeds half of the PET. It was determined for one soil type differing available water holding capacity in 100cm soil profile: 50mm and 100mm storage. LGP was calculated through a simple water balance model of FAO. Further LGP was also calculated based on Thornthwaite water balance model to compute the start and end of growing period at two level of available water holding capacity (AWHC). It related rainfall and moisture stored in the soil to PET of a crop later being observed through Penman formula (Penman 1948). Rainfall and temperature to a lesser extent were widely recorded in the district. Rainfall and to a lesser extent temperature are widely record in the district. A number of parameters required to calculate PET were used from the nearby locations. LGP was calculated over twenty years (1995-2014) of weather data. Annual total duration of growing period, start of growing season and end of growing season were separately calculated for each block of Khordha district. Two modules were used to determine LGP, namely, Length of Growing Period FAO and Length of Growing Period TW. Weekly precipitation (PPT) and potential evapotranspiration (PET) are the required data to calculate

LGP through FAO module. But in TW module along with weekly PPT and PET data, additional informations like earliest week of start (EWS), latest week of start (LWS), earliest week of end (EWE), initial soil moisture (ISM) and available water holding capacity (AWHC) were required to get the result. The parameters, namely, EWS, LWS, EWE, ISM and AWHC were taken as 22, 27, 45, 8 and 50 respectively for Khordha district. Weekly precipitation (PPT) and potential evapotranspiration were used to find out total wet period along with start and end of growing period.

Results and Discussion

Start of growing season

The onset of monsoon determines the start of growing season but the soil type has an important role to play on the feasibility of sowing of crops due to difference in depth of wetting by rainfall and workability of soil. Therefore the start of growing season in each block was computed and presented in Table 1.1 and Table 1.2 for two soil water holding capacities (SWC), 50 and 100 mm. For soil water holding capacity of 50 mm and 100 mm the season commences on an average on 24th SMW in seven out of 10 blocks. In Banapur, Bhubaneswar and Chilika growing season commencements on 23rd SMW at 50 mm soil water holding capacity. But at 100 mm SWC, Bhubaneswar, Banapur and Jatani blocks have the same week of commencement.

End of growing season

In most of the blocks growing season terminates between 48th SMW and 49th SMW at 50 mm of soil water holding capacity (Table 1.1). At 100 mm SWC, growing season normally

terminates in 50th SMW while in Banapur and Bolagarh growing season terminates in 51st SMW. Depending on soil moisture growing season ends one SMW earlier in case of 50 mm of SWC as compare to the soil water holding capacity of

100 mm. In seven out of 10 blocks, growing season terminates between 50th and 51st SMW at 100 mm of SWC (Table 4.14).

Table 1.1 Length of growing period (LGP) at 50 mm soil water holding capacity

Block	Start (SMW)	End (SMW)	Duration (week)	Duration (Days)
Balianta	24	50	27	189
Balipatna	24	50	26	182
Banapur	23	48	26	182
Begunia	24	48	25	175
Bhubaneswar	23	49	27	189
Bolagarh	24	49	27	189
Chilika	23	48	26	182
Jatani	24	50	27	189
Khurda	24	49	26	182
Tangi	24	49	26	182
Khordha	24	49	26	184
STDEV	0.5	0.8	0.7	4.7
CV (%)	2	2	3	3

Duration of growing season

The average duration of growing season for Khordha district is 26 and 27 weeks in soils having water holding capacity of 50 mm and 100 mm respectively. In Balianta, Bolagarh and Jatani, the duration of growing season is above 26 weeks at 50 mm of SWC while Begunia has the lowest growing season duration (25 weeks, Table 4.13). The duration of growing season is longest in Banapur block (29 weeks) at 100 mm of soil WHC while Balianta, Balipatna and Begunia have the growing season duration of below 27 weeks (Table 1.2).

Total annual wet period

Total wet period in a year was calculated by using FAO method. It calculated the total number of days during a year when precipitation exceeds half of the PET. In Khordha the average total number of wet days is 131 days (Table 1.3). Tangi have the highest number of wet days (142 days) followed by Chilika and Banapur (140 days). Balianta and Bolagarh have less number of wet days (<120 days) where Banapur, Bhubaneswar, Chilika, Jatani and Tangi blocks have high number of wet days (>135 days). The lowest number of wet days (115) occurs in Balianta block.

Table 1.2: Length of growing period (LGP) at 100 mm soil water holding capacity

Block	Start (SMW)	End (SMW)	Duration (week)	Duration (Days)
Balianta	24	49	26	182
Balipatna	24	49	26	182
Banapur	23	51	29	203
Begunia	24	49	26	182
Bhubaneswar	23	50	27	189
Bolagarh	24	51	28	196
Chilika	24	50	28	196
Jatani	23	50	27	196
Khurda	24	50	27	189
Tangi	24	50	27	189
Khordha	24	50	27	189
STDEV	0.48	0.74	0.99	6.96
CV	2	1	4	4

Table 1.3 Total annual wet period

Block	Duration (Days)
Balianta	115
Balipatna	123
Banapur	140
Begunia	131
Bhubaneswar	137
Bolagarh	118
Chilika	140
Jatani	139
Khurda	122
Tangi	142
Khordha	131
STDEV	10

except Begunia at 50 mm of soil water storage. Variability in total duration was less among all blocks i.e. <4%. Growing season normally commences at 24th SMW in the district, while it terminates in 49th SMW. Balipatna, Bhubaneswar, Nolaragh and Jatani have maximum duration (189 days), while Begunia have the minimum (175 days) at 50 mm soil water holding capacity (Table 1.1).

At 100 mm soil water storage Banapur has the maximum duration of growing period (203 days). Four out of ten blocks namely, Banapur, Bolagarh, Chilika and Jatani have greater LGP (>195 days) while three blocks namely, Balianta, Balipatna and Begunia have lesser LGP (<185 days) at 100 mm soil water storage. Variability in start and end of growing period in all the blocks was less than 3% (Table 1.2). LGP ends normally between 49th and 51st SMW. From Table 1.1 and Table 1.2 it was concluded that growing season starts with onset of SW monsoon and it lasts up to the end of the

Discussion

The average length of growing season in Khordha is 184 days. All blocks have >180 days of growing season length

year i.e. 51st week. Similar results were found by Pasupalak (2015) that the average duration of growing season for Odisha is 27, 28, 31 and 37 weeks in soils having water holding capacity of 50, 100, 150 and 200mm of soil WHC. Inthavong *et al.* (2011) [3] observed that LGP varied greatly from year to year, particularly in locations with sandy soils, due mostly to variation in monthly rainfall occurring at the early part of the growing season (April), but also to some extent by variation at the end of growing season (October).

Conclusion

The district receives a good amount of rainfall for crop production. On the basis of soil water storage, Khordha has 190 days of average growing period. Hence more than one number of long duration crop (150 days) can't be grown without supplementary irrigation. So there is a need of reorientation of cropping pattern by taking a cereal crop of 120 days duration followed by a pulse crop of 60 days duration to exploit limited cropping season.

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