International Journal of Advanced Technology in Engineering and Science
Vol. No.4, Issue No. 05, May 2016
www.ijates.com
ijates
ISSN 2348 - 7550

FACTORS AFFECTING PADDY PLANT AT DIFFERENT GROWTH STAGES

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ABSTRACT

This paper focuses on finding the impact of various factors (climatic, agronomic practices, water supply factors and biological agent effects and fertilizers used) on the production and growth rate of Paddy. Paddy is the term used for Unmilled rice, which is the part of basic food in majority of Asian countries. After analyzing past yield records and atmospheric conditions, water levels, rain fall records and use of chemicals etc, some facts has been drawn which are expected to increase the yield of Paddy and at the same time, reducing its growth duration.

Keywords: Data Mining, M5p, Regression

I. INTRODUCTION

Paddy is the rice caryopsis with husk. Broadly, rice plant is also known as paddy. It is a wetland crop, which is extensively grown all over the world. Paddy is the primary crop in the majority of the Asian countries including Pakistan, India, Philippine, etc. Rice is the seed of paddy. It is the basic food of the majority of the world population. Rice is an annual crop, but there are some perennial wild rice varieties. India is the second largest producer of paddy and wheat, the world's major staple food crop [14].

To judge the quantity of paddy, we need to study the parameters affecting paddy yield which is the main idea covered in this paper. Paddy yield is affected by climatic, agronomic, water supply factors, agronomic practices and biological agent effects and fertilizers used. Climatic parameters are the parameters which can be evaluated by characteristics such as temperature, rainfall, solar radiation, day length, winds and relative humidity. Agronomic parameters include soil type(such as alluvial soil, black soil, red soil, laterite soil, mountain soil, desert soil), level of soil fertility, soil pH, soil temperature, etc. For paddy cultivation fertile riverine alluvial soil is the most appropriate one [12]. Agronomic practices include how good, clean and healthy seeds are, how land is prepared and the method of crop establishment. Biological agents include the effect of diseases, insects, weeds and other biological agents such as birds, animals, rats, etc.

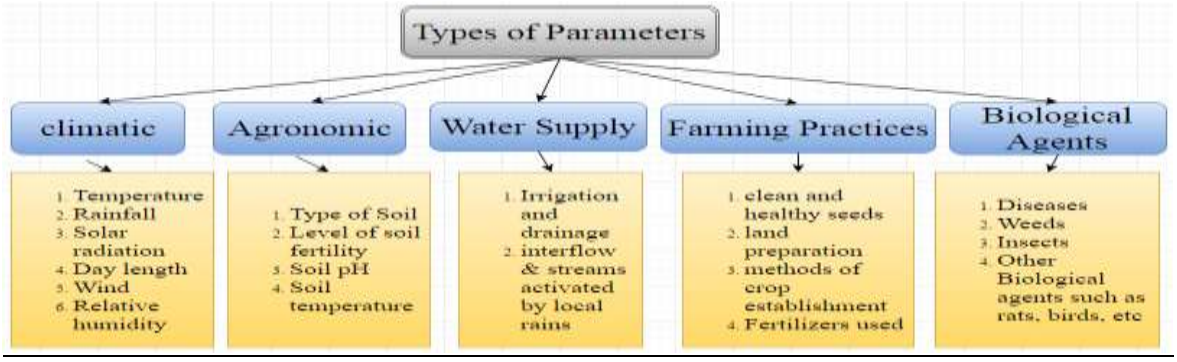

Figure 1: Types of parameters

II. LITERATURE SURVEY

Yunous Vagh, Jitian Xiao [9] presented in their paper a data mining approach to depict the effect of temperature on the wheat yield. Data mining classification GP function is being used for the proposed work. The correlation between the wheat yield and the stochastic average monthly temperature was found a strongly positive one and with the increase in temperature, there is a increase in wheat yield.

B Marinkovic, J Crnobarac, S brdar, B Antic, G Jacimovic, V Crnojevic[3] in their paper used M5P model tree and regression to predict the yield of soybean, maize and sugerbeet. The Bioclimatic method based on hydrophitothermic indices (HFTC) is used for the analysis of water balance in vegetation periods of some crops. For attribute selection, subset selection method i.e, best first method or genetic algorithm has been adopted for the improved accuracy. Yield of maize, sugerbeet and soybean, monthly minimum and maximum temperature and precipitation level were taken under consideration [3].

Ibitoye, S.J. & Shaibu, U.M [4] presented in their paper that both temperature and rainfall had no effect on maize output. They adopted the regression technique to discover the effect of monthly minimum, maximum temperature and rainfall. The results showed that there were very little fluctuations in temperature for the years under consideration and any variation in the output or yield of maize may not be the result of fluctuation in temperature. Similar discrepancies were recorded between the output of maize and the annual mean rainfall [4].

Takuji W. Tsusaka (Philippines), Keijiro Otsuka (Japan) [5] presented the changes in the effects of temperature and rainfall on cereal crop yields in Sub-Saharan Africa, they adopted regression and two way fixed effect model. They analyzed that the dependence of crop yields on weather variables(temperature and rainfall) have changed actually during the period under study. They observed that the temperature effect has lessened for maize and been augmented for millet whereas the rainfall effect has increased for wheat and maize and decreased for rice [5].

Maria Rossana C. de Leon, Eugene rex L. Jalao [7] presented in their paper the dependence of corn yield on climate related variables (like temperature, solar radiation, humidity and rainfall), agronomic variables (like soil type, seed variety, seed rate, fertilizer type, fertilizer amount, weed management, pest management, labor utilization) and other external variable like weather disturbances. Classification Jrip algorithm and subset/attribute evaluator are being used to predict the corn yield using WEKA. Yield per hectare is being discretized to average, low and high. The results showed that climate-related variables are not the chief determinants of corn yield. Rather, planting practices, particularly the amount of fertilization greatly affects the corn yield.

Yunous Vagh, Jitian Xiao[6] presented in their paper a dual effect of rainfall and temperature on wheat yield. They adopted regression and data mining classification function GP for prediction of wheat yield using temperature and rainfall of Western Australia. This amounted to a complex relationship between temperature and the wheat yield prediction where the crop yield could be expected to be better at higher temperatures and worse at lower temperature [6]. The wheat yield can be expected to increase with an increase in temperature associated with a decrease in rainfall [6].

N. Mahmood, B. Ahmad, S. Hassan and K. Baksh [8] presented in their a regression technique to detect the impact of temperature and precipitation on rice productivity. Monthly data of minimum and maximum temperature and rainfall covering period from 1978 to 2007 was taken under consideration. Results showed that average maximum and minimum temperature during September-October and July-August and average minimum temperature and precipitation variables have significant effects on the rice yield [8].

Yunous Vagh [10] presented in their paper a data mining approach to depict the effect of rainfall on heat yield. Data mining classification GP function was used for the proposed work. The discretization of the rainfall was done as low and high. As a consequence of the study, it was concluded that rainfall may not be such a decisive factor for wheat yield [10].

TABLE 1 TECHNIQUES AND PARAMERTERS USED FOR PREDICTION/ESTIMATION OF CROP YILED

Sno.	Author	No. of Parameters	Parameters under study	Technique used	Crop under study	Sources (area and years) of implementation
1	Yunous Vagh[10] in 2012	1	Rainfall	Data Mining Classification Function of GP	Wheat	2002, 2003, 2005 , Australia
2	Farah Khan, Dr. Divankar Singh [1] in 2014	3	Soil type, pH value and season	Apriori algorithm, FP-Growth Algorithm	Bajra, Jowar	Madhya Pradesh
3	Ibitoye, S.J. & Shaibu, U.M [4] in 2014	2	Rainfall and monthly temperature	Regression	Maize	2001 to 2010, Lokoja and Kogi State of Nigeria
4	Yunous Vagh, Jitian Xiao [9] in 2012	1	Temperature	Classification Function GP	Wheat	2002, 2003, 2005, Australia
5	D Ramesh, B Vishnu Vardhan [2] in 2013	2	Rainfall and area of sowing	Multiple Linear Regression and K means Clustering	-	1965 to 2009, East Godwari District of Andhra Pradesh
6	Branko Marinkovic, Jovan Crnobarac, Sanja Brdar, Borislav Antic, Goran Jacimovic, Vladimir Crnojevic [3]	2	Maximum and minimum temperature and precipitation level	M5P model tree and Genetic Algorithm	Maize, Soybean, Sugerbeet	1999 to 2008 of Serbian Province of Vojvodina

7	Takuju W. Tsusaka (Philippines), Keijiro Otsuka (Japan) [5] in 2013	5	Temperature, rainfall, agricultural population density, literacy rate, fertilizers use	Regression and two way fixed effect model	Wheat, rice, maize, sorghum and millet	1989 to 2004, 49 countries
8	N. Mahmood, B. Ahmad, S. Hassan and K. Bakhsh [8] in 2012	2	Minimum and maximum temperature and precipitation	Regression	Rice	1978 to 2007, Punjab (Pakistan)
9	Yunous Vagh, Jitian Xiao [6] in 2012	2	Temperature and rainfall	Regression and data mining classification function GP	Wheat	2001 to 2010, Australia
10	Maria Rossana C. de Leon, Eugene Rex L. Jalao [7]	16	Temperature, rainfall, humidity, solar radiation and 12 other agronomic variables	JRip Classification algorithm	Wheat	1996 to 2012, Quezon

III. VARIOUS STAGES OF PADDY PLANT

Paddy is an annual grass having three agronomic stages of development [15].

3.1 Stages of Paddy Plant

- Vegetative (germination to panicle initiation)
- Reproductive (panicle initiation(PI) to heading)
- Grain filling and ripening or maturation (heading to maturity) [15].

These three stages influence the three yields components:

- Number of panicles per unit land area
- The average number of grain produced per panicle
- Average weight of the individual grains [15].

3.2 Vegetative Stage

The vegetative stage is characterized by a gradual increase in plant height, active tillering and leaf emergence at regular intervals [15]. The following distinct phases occur during vegetative stage:

- Seed Germination
- Seedling Emergence
- Pre-Tillering
- Tillering
- Maximum Tillering
- Vegetative Lag Phase [15].

3.3 Reproductive Stage

The reproductive stage is characterized by culm elongation, decline in tiller number, booting, emergence of flag leaf, heading and flowering [15]. The following steps occur during the reproductive stage:

- Panicle Initiation
- Internode Elongation
- Panicle Differentiation (PD)
- Booting
- Heading
- Anthesis [15]

3.4 Grain Filling and Ripening or Maturation

The Grain filling and ripening or maturation stage follows ovary fertilization and s characterized by grain growth and during this period, the grain size increases in size and weight [15]. Steps in the ripening stage are:

- Milk stage
- Soft dough stage
- Had dough stage
- Maturity [15]

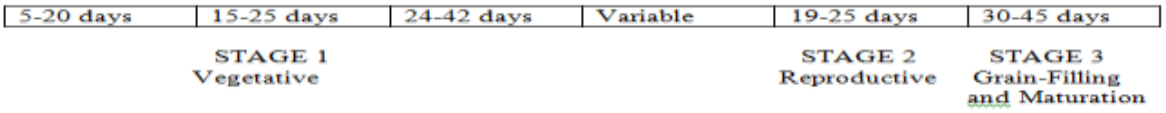

Figure 2: Stages of Paddy Plant and number of days each stage takes to complete

IV. ESSENTIAL PARAMETERS

4.1 Temperature

Paddy being a sub-tropical and tropical plant, fairly requires a high temperature, varying from 20° to 40°C [13]. It greatly influences not only the growth pattern but also the growth duration of the paddy plant [11]. The rice varieties when grown in low temperatures during the cropping season extend growth during as compared to when grown in high temperatures. The minimum temperature for the paddy plant must not go below 15°C as germination does not take place below this temperature [12].

4.2 Rainfall

Paddy cultivation is feasible only in regions having good rainfall, as standing water is required by the crop for growth. About 100-200cm of monthly rainfall is required and during vegetative season, it is required to be 125cm [13]. And during ripening stage, mo water should be there. Without irrigation paddy can be grown only during the wet season and the rice cropping season is decided by the pattern and the length of the rainfall [11].

4.3 Solar Radiation

Solar radiation, a reservoir of energy, is must for plant lives. It is indispensable for photosynthetic activity [11]. During the period of ripening of last 35 to 45 days solar radiations benefits the yield the most [13]. Rice yields are closely correlated to the solar radiation during the reproductive and ripening phases of the rice plants [11].

During the ripening period of the crop, low temperature with bright solar radiations supports in the growth of carbohydrates in the grains [13]. Level of solar radiations affects the development, growth and yield of paddy plant.

4.4 Fertilizers

Three essential nutrients are required by the paddy plant that are nitrogen, phosphorous and potassium [12]. Moderate quantity of nutrients is present in most of the paddy lands, but if deficiency of these nutrients is there, artificial fertilizers or organic manure have to be used [12].

4.5 Water Supply Factors

The paddy plant have generally shallow root system [11]. The most crucial limiting factor to paddy production is water insufficiency and may happen during any time during the cropping season of paddy. The damage to paddy plant varies with the development stage during which the water insufficiency occurs and the duration of the water insufficiency [11]. Damage is usually irreparable and heavy when intensive water insufficiency occurs during flowering and reproductive stages of the paddy plant [11].

V. CONCLUSION

This paper presents a survey of various essential parameters and growth stages of paddy plant. The scrutiny concluded that parameters named temperature, rainfall, solar radiation, wind, relative humidity, type of soil, soil pH, biological agents effect and other agronomic factors and farming practices are of vital importance for estimation of paddy yield. These parameters effect differently the various stages of paddy plant and further the paddy yield.

REFERENCES

[1] Knowledge Discovery on Agricultural Dataset Using Association Rule Mining, Farah Khan, Dr. DivankarSingh, International Journal of Emerging Technology and Advanced Engineering, ISSN 2250-2459, Volume 4, Issue 5, May 2014

[2] Data Mining techniques and Applications to Agricultural Yield Data, D Ramesh, B Vishnu Vardhan, International Journal of Advanced Research in Computer and Communication Engineering, Vol. 2, Issue 9, September 2013

[3] Data Mining Approach for Predictive Modeling of Agricultural yield Data, Branko Marinkovic, Jovan Crnobarac, Sanja Brdar, Borislav Antic, Goran Jacimovic, Vladimir Crnojevic.

[4] The Effect of Rainfall and Temperature on Maize Yield in Kogi State, Nigeria, Ibitoye, S.J. & Shaibu, U.M., Asian Journal of Basic and Applied Sciences, Vol.1, No. 2, 2014, ISSN 2313-7797.

[5] The changes in the effect of temperature and rainfall on cereal crop yields in Sub-Saharan Africa: a country level paney data study, 1989 to 2004, Takuju W. Tsusaka (Philippines), Keijiro Otsuka (Japan), Environmental Economics, Volume 4, Issue 2, 2013

[6] A Data Mining Perspective of the Dual Effect of Rainfall and Temperature on Wheat Yield, Yunous Vagh, Jitian Xiao, International Journal of Computer and Communication Engineering, Vol 1, No. 4, November 2012.

[7] A Predictive Model Framework for Crop Yield Prediction, Maria Rossana C. de Leon, Eugene Rex L. Jalao, Asian Pacific Industrial Engineering and Management System.

[8] Impact of Temperature and Precipitation on Rice Productivity in Rice-Wheat Cropping System of Punjab Province,N. Mahmood, B. Ahmad, S. Hassan and K. Bakhsh, The Journal of Animal and Plant Sciences, 22(4): 2012, Page: 993-997, ISSN: 1018-7081.

[9] Mining Temperature Profile Data for Shire-Level Crop Yield Prediction, Yunous Vagh, Jitian Xiao, Proceedings of the 2012 International Conference on Machine Learing and Cybernetics, Xian, 15-17 July, 2012.

[10] An Investigation into the Effect Of Stochastic Annual Rainfall on Crop Yields in South Western Australia, Yunous Vagh, International Journal of Information and Education Technology, Vol. 2, No. 3, June 2012

[11] Van. Nguu. Nguyen, 'Factors affecting wetland rice production and the classification of wetlands for agricultural production', [online]. Available:http://www.fao.org/docrep/003/x6611e/x6611e03c.htm

[12] Smriti Chand, 'Cultivation of Rice: Suitable Conditions Required for the Cultivation of Rice' [online]. Available: http://www.yourarticlelibrary.com/cultivation/cultivation-of-rice-suitable-conditions-required-for-the-cultivation-of-rice-6-conditions/25491/

[13] Dr.T.Manoharan, 'Botany of Paddy' [online]. Available: http://agritech.tnau.ac.in/expert_system/paddy/Botany.html

[14] 'Agriculture in India' [online]. Available: https://en.wikipedia.org/wiki/Agriculture_in_India

[15] Karen Moldenhauer, Nathan Slaton, "Rice Growth and Development" in Arkansas Rice Production Handbook, Arkansas, ch-2, pp. 9-20.