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## Forecast of brinjal yield by stage wise classified meteorological weeks

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### Abstract

In Chhattisgarh and throughout India, brinjal is the most important vegetable crop grown during the rabi season. Only nine of the twenty districts that make up the Chhattisgarh plain zone have been used in this study; the other eleven districts are newly constituted districts. This study was conducted for the Chhattisgarh plain zone. The study includes yield data for nine districts spanning 16 years, from 2004 to 2021. For the Chhattisgarh plain zone, the de-trend yield of 26 meteorological weeks and the same year's span of data has been employed. This model is developed on composite weather parameter good Range of percent error (PD) showing for all the districts and Zone as well. Minimum and maximum MAE found for Kawardha and Durg i.e. 1692.761 and 6231.02 respectively. Percent error is also on the same term of MAE. Predicted yield is very well near to actual yield. On the basis of above validation factors, we can say that the aforementioned methods demonstrate that both models are highly dependable for forecasting the Brinjal crop at the district and zone levels for the district located in the plain zone of Chhattisgarh. For scientists, statisticians, and agrometeorologists, creating a precise, accurate, and best-fit model for the future projection was an extremely difficult assignment. May this study's novel methods help dispel the haze and establish a fresh approach to forecasting.

**Keywords:** Maximum temperature, minimum temperature, relative humidity, relative humidity sunshine, rainfall, wind velocity, unweighted, weighted, time trend and indicates the variable number, maximum temperature, minimum temperature, relative humidity-i and ii, sun shine (HRS), rainfall, wind velocity, principal component analysis

### Introduction

Brinjal is rich in minerals, including calcium, magnesium, potassium, and iron. Vitamins A and C are abundant. utilized as cooked veggies. used in the dehydration and pickle-making industries. A remedy for toothaches an excellent treatment for liver problems Magnesium and potassium are heart tonic minerals, and green leaves make terrific appetizers. Patients with diabetes can benefit from eating white egg plants. With an annual production of 12777 thousand metric tons and a production area of 736 thousand hectares, India is the world's second-largest producer of brinjal, after China. grown in countries like Indonesia and Egypt as well. In India, 3027.75 thousand metric tons of brinjal are produced annually on 165.15 thousand hectares of cropland. On 37.768 thousand hectares of land in Chhattisgarh, 718.289 thousand metric tons of brinjal are produced. The productivity of brinjal crops is 18.52 metric tons per hectare throughout all 33 districts. (Unknown, 2022). With 4.383 thousand hectares and an annual yield of 110.495 metric tons, Durg is the leading district in terms of area and production, according to the Directorate, C.G., department of agriculture of C.G. Raipur horticulture statistics area and production district.7.)

The average productivity of the brinjal crop is relatively low, although there is room to raise it. Brinjal growth, yield, and fruit quality are primarily influenced by a variety of interrelated elements. However, micronutrients are just as important in plant nutrition as macronutrients, and eggplant is a long-term example of this. Micronutrients have a significant impact on a number of plant metabolic processes, hence balanced fertilization is necessary.

Few researchers, statisticians, and meteorologists are interested in developing a pre-harvest model for the C.G. Plains zone, despite the fact that many have created pre- and post-harvest forecasting models for other crops across the nation.

For the researchers, developing a model for vegetable yield is a novel task. In addition to aiding in crop planning, pricing, storage, and marketing, the development of crop stage-wise models will aid in the creation of forecast models for various vegetable crops.

The type of cultivar grown and the planting season affect spacing. High-yielding types are typically transplanted at 90 × 90 cm spacing, round kinds at 75 x 60 cm, and long-fruited varieties at 60 x 45 cm. In light soils, seedlings are moved into furrows; in heavy soils, they are moved to the side of the ridges. Three to four days before transplanting, a pre-soaking irrigation is administered. The seedlings' roots should be soaked in a Bavistin solution (2g/litre of water) before to transplanting. It is best to perform transplants in the evening, such as aspartic acids, arginine, etc. Some common names for it include Vartaku (Sanskrit), Begun (Bengali), Baigan (Hindi), Vangi (Marathi), and Brinjal (English).

It has been verified that there are roughly 15 to 20 different types of brinjals, which means they come in a broad range of colors and shapes. Flavonoids, alkaloids, and other bioactive substances are abundant in this bushy plant, which comes from a variety of nations. Brinjals are often referred to as the Father of Modern Medicine because of its numerous Ayurvedic therapeutic benefits. Because of its high fiber content and low levels of soluble carbohydrates, brinjal is a powerful tool for type diabetes management.

Brinjal may help blood glucose levels in diabetic animal models, according to studies. According to these researches, people with type 2 diabetes may benefit from using brinjal in their regular diet to aid with blood pressure, glucose levels, and oxidative stress. However, further human research is needed. Brinjal may offer numerous benefits, including the ability to treat diabetes, paralysis, gas, dentistry, and microorganisms. Additionally, it might aid with gout, piles, and stomach bloating. To validate these possible advantages, however, a great deal more research is required.

Consuming brinjals on a daily basis will enable you to enjoy your burgers in a safe manner as well, at least in part, because brinjals may effectively aid in the digestion of lipids and their absorption into the body. Additionally, it includes bioactive chemicals that may help control body weight by solubilizing cholesterol and serum triglycerides (fats). However, additional research on this topic is necessary. It's possible that brinjal could help prevent many cancers, including gastric (gut-related) and lung cancer. Food digestion may be aided by the dietary fiber included in brinjal. It may also eliminate the toxic wastes from the body that eventually helps with cancer of the stomach or colon. This might suggest that brinjal may

help prevent cancer, but there aren't enough research to determine how it affects people's health.

All components of the plant are used to halt intestinal bleeding in traditional Chinese medicine. The plant's fruit is often used as a remedy for poisoning caused by mushrooms. Parts of the plant are used as a purgative in Indochina. Hemorrhoids are treated with dry, heated poultices made from the fruit's ashes in traditional Malay medicine. The root is pounded and put inside the nostrils to treat ulcers. To make a difficult task easier, the Amboinese drink the root juice of a wild species of the plant. Arabs think that the fruit's high "heating" qualities lead to melancholy and insanity. Because of this, Indian and Malay women refrain from eating brinjal for the first forty days following childbirth may also eliminate the toxic wastes from the body that eventually helps with cancer of the stomach or colon. Brinjal may help improve skin tone and the condition of skin, hair, and nails because it contains fat, vitamins, and a lot of water. It might also assist with skin cancer. To declare the aforementioned prospective applications as fact, however, much more thorough investigation is needed in this field. It may also eliminate the toxic wastes from the body that eventually helps with cancer of the stomach or colon. Rare allergic responses may have occurred in recent years as a result of brinjal eating. However, a small class of allergens found in brinjal typically affects some sensitive people. Non-protein metabolites are identified as the possible allergen. The most frequent adverse effects of brinjal include hoarseness (a rough voice), pain, skin rashes all over the body, and throat irritation. See your Ayurvedic doctor right away if such allergic reactions occur.

### Materials and Methods

Model development The Brinjal is crop of *khariif* season are grown from June to November so during this period total number of standard meteorological weeks (SMW) weeks are 26. These 26 weeks will be divide into 3 defined groups.

Stage wise two new generated weather variables based on raw data of weather parameter will be. The multiple regression model for yield forecast based on these stage wise developed weather parameter is given below:

### Model development through multiple regression model on unweighted weather variable

The (MLR) multiple regression model through unweighted weather variable for 1st stage for each weather parameter are fitted as –below (Draper for D smith)

$$y = b_0 + b_1Z_{110} + b_2Z_{210} + b_3Z_{310} + b_4Z_{410} + b_5Z_{510} + b_6Z_{610} + b_7Z_{710} + b_8Z_{810} + T$$

The above procedure for unweighted weather variable will be applied for 2<sup>nd</sup> and 3<sup>rd</sup> stage of Brinjal crop.

### Results

#### Multiple regression model for generated unweighted weather variables

District wise model I has been developed for each stage is stage 1, stage 2 and stage 3. the result of stage wise multiple regression model with unweighted generate variable for every weather parameter for each district has been given in table 4.3.1 The district Raipur shows that only 28% of R square value which is also not significant. for the stage 1 the stage 2 the value of R square is low 38% and non-significant. The

similar result in terms of R square value reveals for model 3 which is non-significant and low as 36% table 4. The result of stage wise forecasting model for district bilaspur shows that the value of R square is 35%, 39% and 32% for stage 1, stage 2 and stage 3 respectively. shows that the value of R square has been reports as 32%, 39% and 37% respectively For stage 1, stage 2 and stage 3 for the district Durg table 4.3.1. As per the result shows below above The value of non-significant R square has been for the 28% to 39% which is very low. So the stage wise model based on only unweighted weather variable is not usefull for the study area.

The district Rajnandgaon shows that only 033% of R square value which is also not significant. for the stage 1 the stage 2

the value of R square is low 38% and non-significant. The similar result in terms of R square value results for model 3 which is non-significant and low as 31% table . The result of stage wise forecasting model for district Mahasamund shows that the value of R square is 31%,39%and 33%for stage 1,

stage 2 and stage 3 respectively table 4. Table 4. shows that the value of R square has been reports as 36%,35% and 35% respectively For stage 1, stage2 and stage 3 for the district Dhamtari.

**Table 1:** Multiple regression model for generated unweighted weather variables

District	Stage	Model variable	R2
RAI	1	$y = -110238 - 0.3040Z110 + 3316.0528Z210 + 137.4266Z310 + 1392.941Z410 + 13113.91Z510 - 11397Z610 + 70377.7Z710 + 6065.56Z810$	0.28
	2	$y = -1784.4 + 493055.0Z120 + 42242.453Z220 - 2.329Z320 + 1075.190Z420 - 203Z520 + 545.91Z620 + 425.854Z720 + 1124.957Z820$	0.38
	3	$y = -8254.6 - 432.68 Z130 + 1334.0334Z230 + 156451.546Z330 - 545.23Z420 - 1753.2016Z520 + 376Z620 + 4854.568Z720 - 4253.8356Z820$	0.36
BSP	1	$y = 810238 - 0.3410Z110 - 0.6912Z210 + 137.4266Z310 + 1392.941Z410 + 13113.91Z510 - 11397Z610 + 70377.7Z710 + 6065.5684Z810$	0.35
	2	$y = 72370.4 + 493055.0Z120 - 85153Z220 - 2.3459Z320 + 1055.190Z420 - 453Z520 + 455.91Z620 + 425.854Z720 + 1424.967Z820$	0.39
	3	$y = 54.600 - 418.680 Z130 + 1342.0350Z230 + 146461.646Z330 - 570.23Z420 - 1753.2016Z520 + 376Z620 + 4854.568Z720 - 4843.8356Z820$	0.32
DRG	1	$y = 371238 - 0.0081Z110 - 0.7258Z210 + 137.4866Z310 + 1492.94871Z410 + 14113.91Z510 - 15397Z610 + 76377.7Z710 + 6055.5684Z810$	0.32
	2	$y = 18000.4 + 12003055.0Z120 - 2453Z220 - 2.529Z320 + 1575.195Z420 - 263Z520 + 545.51Z620 + 465.854Z720 + 1124.567Z820$	0.39
	3	$y = 13254.6 - 102.68 Z130 + 1334.0650Z230 + 176461.546Z330 - 540.23Z420 - 1453.2016Z520 + 376Z620 + 4954.568Z720 - 4843.8756Z820$	0.37
RJD	1	$y = 23023.8 - 0.30210Z110 - 0.0238Z210 + 137.5266Z310 + 9392.94801Z410 + 43113.91Z510 - 11497Z610 + 70377.4Z710 + 6465.5654Z810$	0.33
	2	$y = 6450.4 + 62035.0Z120 - 800.443Z220 - 2.529Z320 + 3075.194Z420 - 603Z520 + 565.91Z620 + 625.854Z720 + 1424.957Z820$	0.34
	3	$y = 54254.6 - 903268.2 Z130 + 4234.0300Z230 + 154461.546Z330 - 540.23Z420 - 1453.2016Z520 + 356Z620 + 4754.568Z720 - 6243.8356Z820$	0.33
MSD	1	$y = 760238 - 0.4000Z110 - 0.3423Z210 + 337.4265Z310 + 1592.95801Z410 + 53113.95Z510 - 11357Z610 + 75377.7Z710 + 5065.5684Z810$	0.31
	2	$y = -1070.4 + 480045.0Z120 - 84253Z220 - 2.329Z320 + 1074.190Z420 - 243Z520 + 5456.61Z620 + 465.854Z720 + 1624.957Z820$	0.33
	3	$y = 19305.6 - 43536.68 Z130 + 1534.0350Z230 + 155461.546Z330 - 550.23Z420 - 5653.2016Z520 + 556Z620 + 47554.568Z720 - 5243.8356Z820$	0.34
DMT	1	$y = -120538 - 0.3540Z110 - 0.0438Z210 + 135.4266Z310 + 1342.94801Z410 + 43113.91Z510 - 11497Z610 + 74377.7Z410 + 6045.5684Z810$	0.39
	2	$y = 1370.4 + 483055.0Z120 - 8624.53Z220 - 2.329Z320 + 1075.190Z420 - 203Z520 + 445.91Z620 + 455.854Z720 + 1524.957Z820$	0.36
	3	$y = 85254.6 - 472.68 Z130 + 1734.0300Z230 + 176461.546Z330 - 770.23Z420 - 1653.7016Z520 + 376Z620 + 4757.568Z720 - 4743.8356Z820$	0.35
KWD	1	$y = 140638 - 0.3040Z110 - 0.0658Z210 + 167.4266Z310 + 1692.941Z410 + 16113.91Z510 - 11367Z610 + 76377.7Z710 + 60665.56Z810$	0.35
	2	$y = 2150.4 + 463055.0Z120 - 846453Z220 - 2.369Z320 + 1675.190Z420 - 263Z520 + 545.61Z620 + 425.654Z720 + 1164.957Z820$	0.37
	3	$y = -86254.6 - 486.68 Z130 + 1634.0300Z230 + 156461.546Z330 - 670.23Z420 - 1663.2016Z520 + 366Z620 + 4764.568Z720 - 4263.8356Z820$	0.36
KRB	1	$y = -160238 - 0.7640Z110 - 0.06Z210 + 137.4666Z310 + 1392.961Z410 + 16113.91Z510 - 11367Z610 + 70677.7Z710 + 6665.5684Z810$	0.37
	2	$y = 1370.4 + 453055.0Z120 - 855453Z220 - 2.529Z320 + 1075.590Z420 - 203Z520 + 555.95Z620 + 425.554Z720 + 5124.955Z820$	0.34
	3	$y = 49254.6 - 442.68 Z130 + 1434.0340Z230 + 154461.546Z330 - 470.23Z420 - 1463.2016Z520 + 466Z620 + 4464.568Z720 - 4243.8356Z820$	0.39
JNG	1	$y = 3410238 - 0.3480Z110 - 0.4528Z210 + 137.4264Z310 + 1392.441Z410 + 13413.91Z510 - 11397Z610 + 74377.7Z710 + 4065.5684Z810$	0.35
	2	$y = 2240.4 + 454055.0Z120 - 834453Z220 - 2.324Z320 + 1075.140Z420 - 204Z520 + 544.91Z620 + 445.854Z720 + 1124.957Z820$	0.39
	3	$y = -78454.6 - 842.68 Z130 + 1634.0500Z230 + 156451.546Z330 - 570.53Z420 - 5653.2016Z520 + 356Z620 + 4554.568Z720 - 4543.8356Z820$	0.37

The district Kawardha shows that only 0.35%% of R square value which is also not significant. for the stage 1 the stage 2 the value of R square is low 36% and non-significant. The similar result in terms of R square value reveals for model 3 which is non-significant and low as 37% The result of stage wise forecasting model for district Korba shows that the value

of R square is 34%,39%and 35%for stage 1, stage 2 and stage 3 respectively. shows that the value of R square has been reports as 35%,39% and 37% respectively For stage 1, stage2 and stage 3 for the district Janjgir Table

## Conclusion

The average productivity of the brinjal crop is relatively low, although there is room to raise it. Brinjal growth, yield, and fruit quality are primarily influenced by a variety of interrelated elements. However, micronutrients are just as important in plant nutrition as macronutrients, and eggplant is a long-term example of this. Because micronutrients are crucial to many plant metabolic processes, it is necessary to fertilize both macro and micronutrients in a balanced manner. Many enzymes, including dehydrogenase, aldolase, isomerase, proteinase, peptidase, and phosphohydrolase, depend on zinc for their metal activation in plants. Weather conditions may be linked to zinc insufficiency. Chhattisgarh.

The crop yield forecasting based on stage wise classified weeks of crop like brinjal not showing more significant for stage1 and stage2 because very less amount of weeks considered under the development of the model only stage3 found significant based on 17 weeks dots. This study (an carry forward for many other serial crops and vegetable crops. Which may be useful for the researchers scientists of the develop forecasting field.)

Weekly average data converted in monthly average data on the given monthly, Brinjal crop only 5 months and I month covers only two weeks, II month 4 weeks, III month 4 weeks, IV month 4 weeks, and V month 3 weeks. Total number of week's covers under the study was 17 and minimized in 5 weeks. e. monthly average data of the separate months. Total new 8 variables constructed.

The study of individual through 8 new generated variables has been made. Time trend T found significant almost for all the districts and all the weather parameters. Monthly average data for 3<sup>rd</sup> month for Dhamtari district has been found significant. The value of R<sup>2</sup> found very high and well enough significant at good level of significance. This indicates that the role of individual effect is significant on crop yield.

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