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## A STUDY OF CORELATION OF PRODUCTION OF MAIZE AND RAINFALL IN SOLAPUR DISTRICT

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### ABSTRACT:

The Solapur is agriculturally progressive district of Maharashtra. The district is taking number of food and commercial crops. But here rainfall unevenly distributed. Few tehsils are receiving very high rainfall and few are drought prone. But irrigation facilities are developing here therefore few tehsils crop productivity is high. But then also number of tehsils are depend on rainfall for production therefore here correlation between production of Maize and rainfall is assessed because maize is one of the prominent food crop in Solapur district. Correlation is assessed by product moment correlation method. This analysis shows the areas which receive very low rainfall showing negative or very low correlation and areas which receive high rainfall showing positive correlation.

### INTRODUCTION:

We know that Solapur district is agriculturally one of the most progressive districts of Maharashtra. It is characterized by spatial differences in physical features. The Agro climatically entire district comes under the rain shadow area. Rainfall is uncertain and scanty. In this district, mostly agriculture depends on rainfall and the farmer takes seasonable crops in the farm. The temperature, rainfall and humidity conditions apparent that the region has a distinctive monsoon climate with three seasons, over and above the 80 percent annual rain is concentrated in the months of June to September and it varies from 559.20 mm at Akluj near the western border to 767.45 mm and Barshi tehsil which is nearer to Balaghat range with its average rainfall 725 mm. The district gets rain from south-west as well as from north-east monsoons. Agriculture in the district is mainly dependent upon rainfall. There is a co-relation between rainfall and crop production. Temperature and Sunshine are favorable throughout the year and provide growing conditions for crops in the district. The rainfall, therefore, controls

the pattern of crops, rotation of crops and the productivity of the land in the district. Broadly speaking, the district can be divided into three natural zones. The eastern zone comprising Barshi, North Solapur, South Solapur and Akkalkot tehsils have certain rainfall. The central or the traditional zone comprising Mohol, Mangalwedha, eastern part of Pandharpur and Madha tehsils has uncertain rainfall and the western zone which comprises the scarcity areas of Karmala, Sangola and Malshiras tehsils and the western parts of the Madha and Pandharpur tehsils has also uncertain rainfall. The farming practices are adjusted according to the normal features of the rainy season and expectations are made on the basis of these characteristics.

There are two main agricultural seasons in the district as Kharif and rabbi. Particulars regarding these can be described as follow.

**Kharif season:** The kharif season begins from the first week of June and stays up to November-December. The south-west monsoon starts from June which is mainly useful for pre-sowing, preparative cultivation of the soil. The sowing processes start with these rains when the regular south-west rains set in by the fourth week of June. Special significance is given to the sowing of the cotton crop during the MrugNakshatra(Rainy season starting period) as it results in good yield. For the kharif crops, lands are cultivated during April and May. With the onset of the monsoon, the farmers start sowing processes. Kharif crops are harvested in the months of November-December. Due to the uncertainty of rains, irrigation is also required to be given to kharif crops wherever irrigation facilities are available. Cotton, Paddy, tur, groundnut, Bajra, maize, black gram, etc. are the main crops which are grown in the Kharif season.

**Rabbi season:** The rabbi season begins from the middle of October. The land is cultivated in the months of October-November for rabbi season. The preparative cultivation, such as harrowing is done before sowing. From the first week of October sowing of rabbi crops begins. They are shown in non-irrigated fields. In the month of January the Jowar crop is being harvested and wheat and gram crops are harvested in the month of March. The rabbi crops are generally grown as rain-fed crops on a large scale and are irrigated wherever the irrigation facilities are available e.g. jowar, wheat and gram.

**Hot-weather crops:** Hot-weather crops are also grown in the district besides the kharif and rabbi crops. The preparative cultivation is completed for the sowing of hot-weather crops immediately after the harvest of rabbi crops. In the months of March-April the crops like maize, ground-nut, etc., are sown and in the month of April the irrigated cotton crop is also planted, where adequate irrigation facilities are available. Another hot-weather crops are also grown where adequate irrigation facilities are available

such as ground-nut and maize. The other agricultural practices are the same as comparing those for the kharif crops.

The district has a considerably more area under the rabbi crops rather than under kharif crops. In Barshi tehsil the proportion of kharif and rabbi area is more or less equal whereas all other tehsils have a very high proportion of the area under the cultivation of rabbi crops.

### THE PRODUCT MOVEMENT CORRELATION COEFFICIENT

This is the most powerful tests of correlation, but it is a parametric test and all the necessary conditions must be satisfied before it can be used. A correlation coefficient is a statistic which describes the degree of association between two sets of paired values, and is used as such here. Usually the coefficient is subject to a test for significance like any other technique in inferential statistics. In this case, however, because we have chosen to correlate a sample of numbers known to be random numbers tends towards an even distribution and therefore a test for significance is not valid. The method of testing the significance of  $r$  where this may properly be applied is the same as that for Spearman's rank correlation.

The use of following first formula to obtain  $r$  is rather laborious and inconvenient unless some form of calculating machine is available to do the arithmetic. Fortunately, as with the standard deviation, a more suitable formula for machine computation may be found, and

$$r = \frac{\frac{1}{n} \sum (a - \bar{a})(b - \bar{b})}{\sigma_a, \sigma_b}$$

Becomes

$$r = \frac{\sum(a . b) / n - \bar{a} . \bar{b}}{\sigma_a, \sigma_b}$$

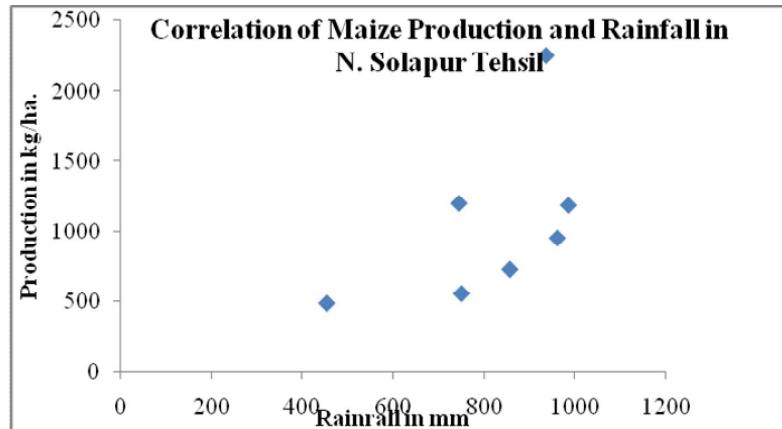
### RABBI MAIZE PORDUCATION IN SOLAPUR DISTRICT

#### Rabbi Maize Porducation in Solapur District

Tehsil	T-Test	P Value
N. Solapur	1.4441	0.1919
S. Solapur	0.3309	0.754
Barshi	0.7110	0.5164
Akkalkot	0.0596	0.9544
Mohol	2.3729	0.0450
Madha	2.7350	0.0256
Karmala	0.3268	0.7522
Pandharpur	3.7184	0.0075
Sangola	5.2363	0.0008
Malshiras	5.3979	0.0006
Mangalwedha	4.0371	0.0038

## 1. Maize Porducation in N.Solapur Tehsil

Figure No. 1: Correlation of Maize Production and Rainfall in North Solapur Tehsil

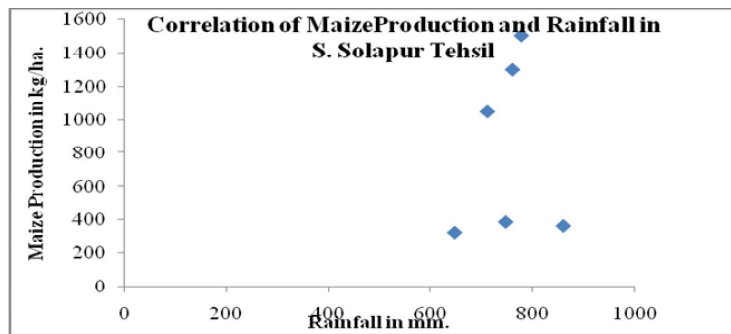


This graph reveals highly positive co- relation between productivity and rainfall for the Maize crop in North Solapur tehsil. From the year 2003 to 2011 the rainfall and productivity, it is observed, was increased. Means in the year 2003 the production was around 485 kg. /ha, where the rainfall recorded in the same year was 453.3 mm. In the year 2011 the production is 1090 where the rainfall is 773.4. But in the particular year 2007, the production is suddenly increased up to 1200 kg/ha and rainfall is slightly increased. In 2010 production is doubled up to 2250 kg/ha as compared to previous years and rainfall is normally decreases than the particular year 2009. Most part of these tehsil is non irrigated. For the cultivation, farmers are largely dependant on rainfall. In these tehsil maximum crops are seasonable.

By observing these tehsil, it is the studied as the product movement correlation method, the P value and statistical significance and the two-tailed P value equals 0.1919. Therefore, by conventional criteria, this difference is considered to be not statistically significant. The confidence interval is the mean of Rabbi Maize minus Rainfall equals 247.113 and 95% confidence interval of this difference is from -157.524 to 651.749. The t-test value is 1.4441 and standard error of the difference is 171.121 observed.

## 2. Maize Porducation in S.Solapur Tehsil

**Figure No. 2: Correlation of Maize Production and Rainfall in South Solapur Tehsil**

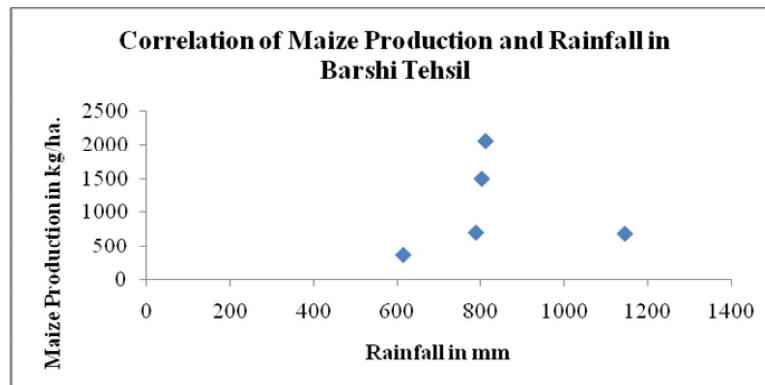


This graph reveals slightly positive correlation between rainfall and production in South Solapur for Maize crop. From the particular years from 2006 to 2011, both the production and rainfall were increased. Means in the particular year 2006 the production was 323 kg/ha, rainfall was 647.7 mm. and in 2011 productivity was 1050 kg/ha, rainfall was 711.5 mm. In 2007 production and rainfall was suddenly increased and in 2008 production was rapidly decreasing, rainfall was normally decreased. Then in 2009 production is drastically increased up to 1507 kg/ha and rainfall was little increased than last year. In the South Solapur tehsil farmers are using high yielding variety seeds and maximum use of fertilizers. Irrigation facilities of the particular tehsil increase in subsequent years.

The Product Movement correlation method calculates the P value and statistical significance and the two-tailed P value equals 0.754. Therefore, by conventional criteria, this difference is considered to be not statistically significant. The confidence interval is the mean of Rabbi Maize minus Rainfall equals 71.267 and 95% confidence interval of this difference is from -482.389 to 624.922. The t-test value is 0.3309 and standard error of the difference is 215.381.

### 3. Maize Production in Barshi Tehsil

**Figure No. 3: Correlation of Maize Production and Rainfall in Barshi Tehsil**

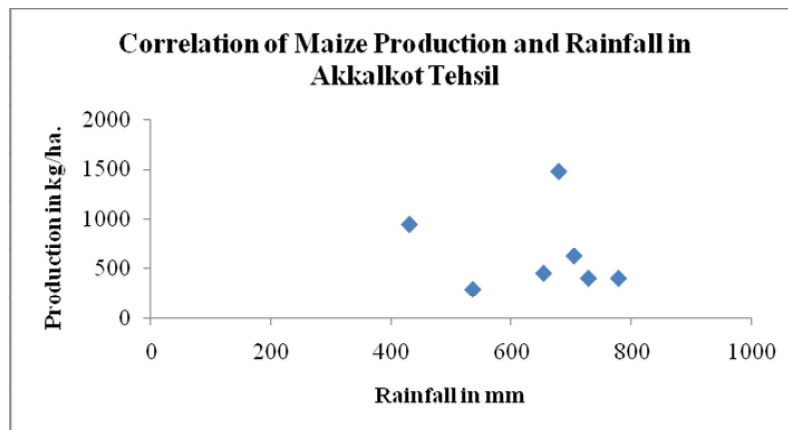


By observing this graph, it can be put that there is no significant correlation between rainfall and production of the maize crop. A general trend of rainfall was increasing and production was decreasing from the period of 2006 to 2011. I.e. in the year 2006 production was 1500 kg/ha, rainfall was 802.6 mm and in 2011 production was 360 kg/ha and in 2010 rainfall was 1145 mm but in 2011 rainfall was decreased up to 614.7mm. In the year 2007, the production as well as rainfall was increased up to 2065 kg/ha and 811.7 mm respectively. Then in 2008 production (700 kg/ha) was suddenly decreased and rainfall (788.7) was low as compared to the year 2007. From 2008 to 2011 production was continuously decreasing and rainfall was increased up to 2010. Barshi tehsil is a leading in Jowar production in Solapur district. In this tehsil Maize cultivation is practiced in Kharif (Rainy) season, so Barshi tehsil having very low irrigation facilities are observed.

In Barshi tehsil production and rainfall correlation studied by product movement correlation method and calculating P value and statistical significance is the two-tailed P value equals 0.5164 therefore by conventional criteria, this difference is considered to be not statistically significant. The confidence interval is the mean of Rabbi Maize minus Rainfall equals 229.260 and 95% confidence interval of this difference is from -666.028 to 1124.54. The t-test value is 0.7110 and standard error of the difference is 322.458.

#### 4. Maize Porduction in Akkalkot Tehsil

Figure No. 4 : Correlation of Maize Production and Rainfall in Akkalkot Tehsil



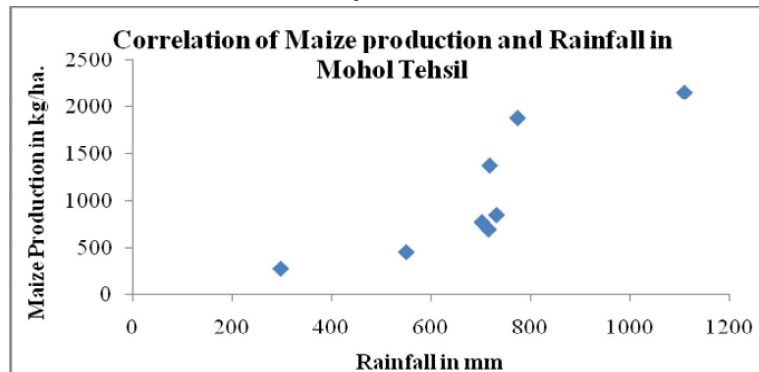
This graph introduces no significant correlation between rainfall and production in Akkalkot tehsil for the maize crop. In the period of 2003 to 2011 rainfall and production is somewhat imbalanced means sometimes it slightly increased and sometimes decreased respectively. Means in the year 2003 the rainfall was around 429.6 mm, where the production was around 942 kg/ha. and in 2011 the rainfall is 704 mm and then production is nearly 623 kg/ha. Then in 2004 production was suddenly decreased up to 288 kg/ha and rainfall was increased. But in 2005 production and rainfall was tremendously improved.

Then in 2006 production was again decreased. From 2006 to 2010 production was constant and then suddenly increased in the year 2011. But the rainfall is continuously increased. In Akkalkot tehsil Sina river bank is available and the area of Southern part of that tehsil is irrigated. That's why, farmers from the area cultivate cash crops.

In that tehsil Product Movement correlation method is P value and statistical significance and the two-tailed P value equals 0.9544. Therefore, by conventional criteria, this difference is considered to be not statistically significant. The confidence interval is the mean of Rabbi Maize minus Rainfall equals 10.314 and 95% confidence interval of this difference is from -412.941 to 433.569. The t-test value is 0.0596 and standard error of the difference 172.975.

### 5. Maize Production in Mohol Tehsil

Figure No. 5: Correlation of Maize production and Rainfall in Mohol Tehsil

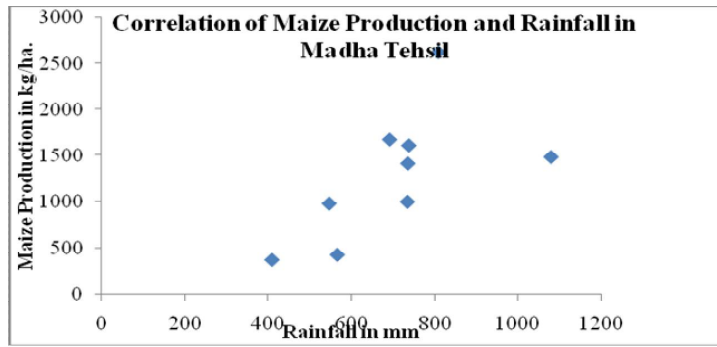


Observation of the above graph shows positive co-relation of rainfall and production of maize. During the duration of 2003 to 2011 the rainfall and production were tremendously increased, i.e. in 2003 rainfall was 298.1 mm and the production was 275 kg/ha and in the year 2011 the rainfall was 697.9 mm and the production was 2233 kg/ha. The Rainfall and production continuously increased from 2003 to 2011 but in 2008 production was suddenly decreased. Western part of Mohol tehsil is mostly irrigated which is located on the Sina river bank. There is high cash and food crop cultivation, however remaining part of this tehsil is totally depend on rain and their crop is seasonable. In that region, geographical condition is suitable for Maize crop.

In that tehsil Product Movement correlation method is applied for rainfall and production correlation. In this method P value and statistical significance and the two-tailed P value equals 0.0450 the by conventional criteria, this difference is considered to be statistically significant. The confidence interval is the mean of Rabbi Maize minus Rainfall equals 510.722 and 95% confidence interval of this difference is from 14.393 to 1007.051. The t-test value is 2.3729 and standard error of the difference is 215.233 observed.

**6. Maize Production in Madha Tehsil**

**Figure No. 6 : Correlation of Maize Production and Rainfall in Madha Tehsil**

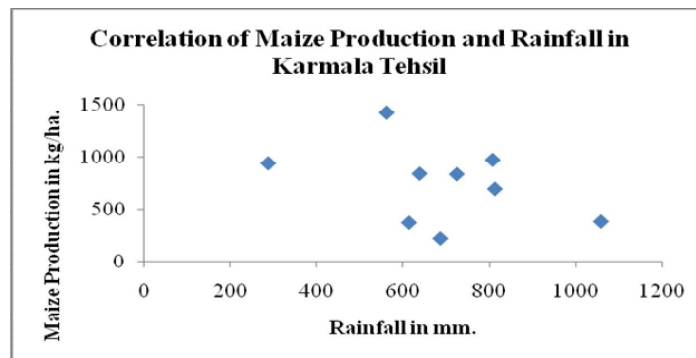


It shows co-relation between production and rainfall for the maize crop. This graph Presents positive co- relation. In the time period of 2003 to 2011 increased production and rainfall is seen, i.e. in 2003 production of Maize was 375 kg/ha, where the rainfall was 410 mm. and in 2011 the production was 1680 kg/ha and the rainfall was 691.7 mm. In the year 2005 the production was suddenly increased up to 2630 kg/ha because in that year rainfall was comparatively high. Then in the year 2006 the rainfall and production were decreased, i.e. 566.2 mm and 431 kg/ha respectively. In 2007 to 2011 rainfall and production was again increased.

Calculating the product movement correlation method, it is observed P value and statistical significance and the two-tailed P value equals 0.0256 then by the conventional criteria, this difference is considered to be statistically significant. The confidence interval is the mean of Rabbi Maize minus Rainfall equals 642.467 and 95% confidence interval of this difference is from 100.770 to 1184.164. The t-test value is 2.7350 and standard error of the difference is 234.90. The Central part of Madha tehsil drained Seena river and this river bank area is mostly irrigated. There geographical condition is suitable for maize crop. So that region is cultivating cash crops.

**7. Maize Production in Karmala Tehsil**

**Figure No. 7: Correlation of Maize Production and Rainfall in Karmala Tehsil**



In the Karmala tehsil the chart does not indicate any significant co- relation between rainfall and production. During the period from 2003 to 2011

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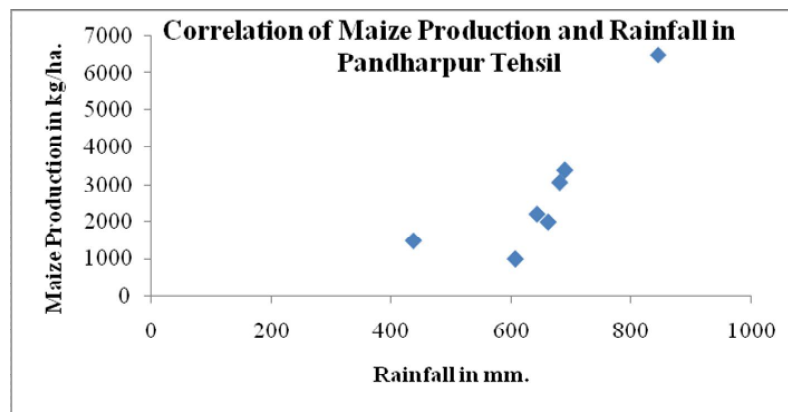


the production was decreased and the rainfall was increased means in the year 2003 the production was 940 kg/ha and the rainfall was about 286.9 mm and in the year 2011 the production was 370 kg/ha where the rainfall was 613 mm. But in the year 2006 the rainfall (561.4 mm) was little decreased and production (1425 kg/ha) was increased as compared to last year. West and south western part of Karmala tehsil is located along the backwater of Ujni dam. Its effect on the tehsil is that the tehsil is mostly irrigated. It's impacted on other products that the most of the agriculture is diverted from food crops to cash crops because of the Maize production in Karmala tehsil decreased.

In this tehsil product movement correlation is observed, i.e. P value and statistical significance, then the two-tailed P value equals 0.7522 and by conventional criteria, this difference is considered to be not statistically significant. Therefore the confidence interval is the mean of Rabbi Maize minus Rainfall equals 54.156 and 95% confidence interval of this difference is from -328.040 to 436.351. The t-test value is 0.3268 and the standard error of the difference is 165.739 observed.

## 8. Maize Production in Pandharpur Tehsil

**Figure No. 8: Correlation of Maize Production and Rainfall in Pandharpur Tehsil**



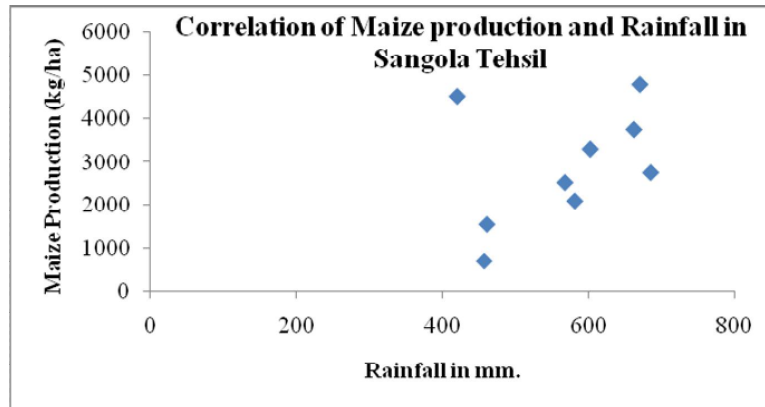
By observing this graph it comes to know that there is a positive correlation between the rainfall and the production in Pandharpur tehsil. From the year 2003 to 2010 the production and rainfall was continuously increased means in the year 2003 the production was 1484 kg/ha., and the rainfall was 436.7 mm. Again in the year 2010 the production of maize was 6500 kg/ha. It was rapidly increasing and the rainfall was 845 mm. Its slowly increased. The years from 2003 and 2010 show a positive correlation, but as compared to 2003, there was a rapid positive correlation in the year 2010. In the year 2011 both the rainfall and the production are decreased. It was a drougha. prone condition in Solapur district at that time. Pandharpur tehsil is leading in irrigation in Solapur district.

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Product movement correlation method presented P value and statistical significance also the two-tailed P value equals 0.0075 and by conventional criteria, this difference is considered to be very statistically significant. Then the confidence interval is the mean of Rabbi Maize minus Rainfall equals 2270.125 and 95% confidence interval of this difference: From 826.507 to 3713.743. The t-test value is 3.7184 and the standard error of the difference is 610.507.

## 9 Maize Production in Sangola Tehsil

Figure No. 9: Correlation of Maize Production and Rainfall in Sangola Tehsil

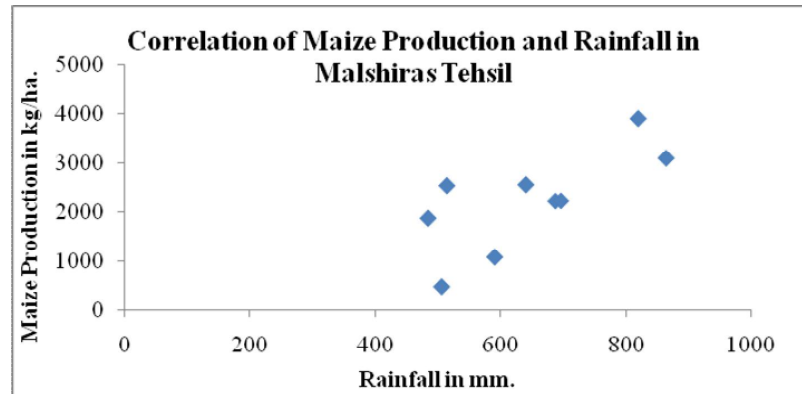


From this graph it comes to know that there is a positive correlation between the production and rainfall in Sangola tehsil. Most part of Sangola tehsil was non irrigated. The agriculture profession from that area was totally depend on rainfall and because of that crops are seasonable. In the tehsil rainfall and production was increased during the year 2003 to 2010. Means in the year 2003 production of Maize were 1550 kg/ha. Whereas rainfall was 460.9 mm and in the year 2010 production was 4788 kg/ha. and the rainfall was 669.2 mm. The average production of Sangola tehsil was 2886.39 kg/ha. and the average rainfall was 567.19 mm. In the year 2004 the production was suddenly decreased and the rainfall was normally decreased. The rainfall was averagely low, i.e. 700 kg/ha and 457 mm respectively. Alternate year production was increased and decreased but rainfall was normal from the year 2003 to 2010. In the year 2011 production and rainfall again decreased. It was the beginning of the drought-prone condition.

In Sangola tehsil calculating product movement correlation method for Maize crop. The P value and statistical significance for the two-tailed P value equals 0.0008 also by conventional criteria, this difference is considered to be extremely statistically significant. Then the confidence interval is the mean of Rabbi Maize minus Rainfall equals 2297.033 and 95% confidence interval of this difference is from 1285.456 to 3308.611. The t-test value is 5.2363 and the standard error of the difference is 438.671.

## 10. Maize Production in Malshiras Tehsil

Figure No. 10 Correlation of Maize Production and Rainfall in Malshiras Tehsil

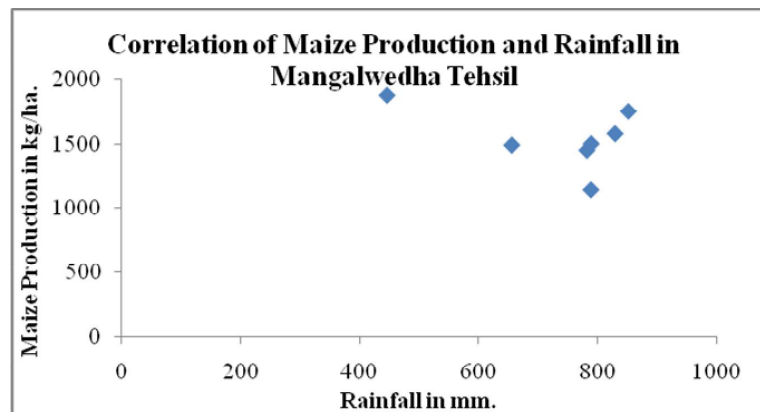


The graph reveals positive co- relation between the production and the rainfall of maize crop in Malshiras tehsil. In this tehsil Nira river bank area is irrigated but remaining part of this tehsil is mostly dependent on rainfall. In this tehsil from the year 2003 to 2010 the rainfall as well as production was continually increasing, i.e. in the year 2003 the production was 1875 kg/ha and rainfall was 485 mm also in the year 2010 the production was 3900 kg/ha. and the rainfall was 819.3 mm but in the year 2007 the production (2225 kg/ha) was decreased as compared to the year 2006 (2564 kg/ha.). In 2008 to 2010 production was again increased. The rainfall was continuously increasing from 2003 to 2010. But in 2011 the production and rainfall were decreased, i.e. 2544 kg/ha and 518.8 mm respectively. In 2011 the rainfall and production was low as compared to year 2010 because the droughtprone condition in Solapur district was just affecting.

In Malshiras tehsil calculating product movement correlation method for Maize crop. The P value and statistical significance, then the two-tailed P value equals 0.0006 and by the conventional criteria, this difference is considered to be extremely statistically significant. The confidence interval is the mean of Rabbi Maize minus Rainfall equals 1596.878 and 95% confidence interval of this difference is from 914.689 to 2279.067. The t-test value is observed 5.3979 and the standard error of the difference is 295.832.

### 11. Maize Porducation in Mangalwedha Tehsil

Figure No. 11: Correlation of Maize Production and Rainfall in Mangalwedha Tehsil



In this graph negative co-relation of production and rainfall is observed in Maize production in Mangawedha tehsil. In presenting the record from the year from 2003 to 2011 both of production and rainfall. There is continuous increment and decrement year by year in the rainfall and production. In 2003 the production was 1878 kg/ha and rainfall was 447.5 mm. But in 2004 rainfall (789 mm) was increased and production (1145 kg/ha.) was decreased. Then in 2005 rainfall (782.4) was increased and production (1453 kg/ha) was decreased. Observation of this year shows negative co-relation. In 2006 and 2007 rainfall and production, both were increased. In 2008 production and rainfall is again increased. In 2011 the production (2003 kg/ha) was suddenly increased as compared to last eigha years and rainfall (410.3) was rapidly decreased as compared to last eigha years. In the year of 2011 the co-relation of rainfall and production is totally negative. It was beginning of a drougha. prone condition in 2011 in all tehsils of Solapur district, but some part of Mangalwedha tehsil has irrigation facilities available therefore there are maize crop practices. In Rabbi season the Jowar crop is mostly practices that's why in Rabbi season other crop cultivated area is reduced.

In Mangalwedha tehsil applying product movement correlation method for determining the correlation of rainfall and production. The P value and statistical significance also the two-tailed P value equals 0.0038 and by the conventional criteria, this difference is considered to be very statistically significant. The confidence interval is the mean of Rabbi Maize minus Rainfall equals 777.444 and 95% confidence interval of this difference is from 333.360 to 1221.529. The t-test value is observed 4.0371 and standard error of the difference is 192.577.

**CONCLUSION:**

In Manglawedha, Barshi, South Solapur Akkalkot there is no correlation among production of Maize and rainfall all these areas drought prone areas receives very low rainfall and irrigation facilities are low but in Mangalvedha, Pandharpur, Mohol, Madha and North Solapur these tehsils are showing positive correlation because these tehsils are receiving high rainfall as compare to above tehsils. And here irrigation facilities are also high which also depend on the rainfall.

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