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IMPACT OF IRRIGATION ON AGRICULTURAL DEVELOPMENT IN SEDAWGY1 REGION (MYANMAR) - A GEOGRAPHICAL ANALYSIS

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Abstract

Irrigation is any human-induced change in the natural flow of water for the purpose of growing plants. Irrigation water is usually delivered to farms through canal networks or pipes. Common sources of water include rivers, streams and underground aquifers. Drainage is the removal of excess water from the land to reduce yield losses due to flooding, water logging and salinity. Rice is grown on approximately one-third of the world's irrigated cropland and 50% of Asia's irrigated cropland. Most of the rice is grown in areas dominated by a monsoon climate. During this period, a major portion of the increase in global food production came from increased yields on an expanded area of irrigated land.

Keywords

Irrigation, Hydrology, Productivity, Cropping Pattern, Sedawgyi Region(Myamnar). Chaungmagyi, Madaya, Patheingyi, Mandalay, Amarapura.

Introduction

Irrigation is the per-requisite for the adoption of a new technology in agriculture and for the rapid growth of the agricultural sector. It has particularly marked effect upon the hydrology of semi-arid and and zones where natural evaporation is very slight owing to the lack of water. Irrigation is the supply of water to a crop on a recurrent seasonal basis and/or is a permanent land improvement which changes the ecological land conditions (or) is a non recurrent investment and/or is soil improvement in the strictest sense, because it changes the characteristics of the soil profile. Irrigation may often be all in combination of these together. The purpose of irrigation is to counteract drought by making certain that the plants are not deprives of water at any time during their development. The development of irrigation affects agricultural in several ways, especially for out coming of the crop more certain than in its absence.

The immediate impact of irrigation is on cropping pattern, leading to a shift from less remunerative to more remunerative such as paddy, which requires an assured water supply. Irrigation is also expected to increase overall productivity. Civilizations have raised on irrigated land. Though irrigation has been considered necessary for progressive and successful in agriculture, its development has been rather slow in Myanmar. The present paper attempts to highlights the importance of irrigation in Sedawgyi Region (Myanmar) for the period of 15 years period i.e. 1985-86 to 1999-2000 and only for the year of 1999-2000. Before 1987, the Sedawgyi region was supplied water by weir and the dam has started constructing across the Chaungmagyi stream near Sedaw village in 1987 with the aid of A.D.B. The dam has started supplying water in 1987-88 by two main canals; Mandalay and Yenantha. Before completion of the dam, the net irrigated area was 91,223 acres and it has been increased upto 99,631 in 1999-2000. The gross cropped area has also been increased from 1,93 099 acres in 1985-86 to 2,40,263 in 1999-2000.

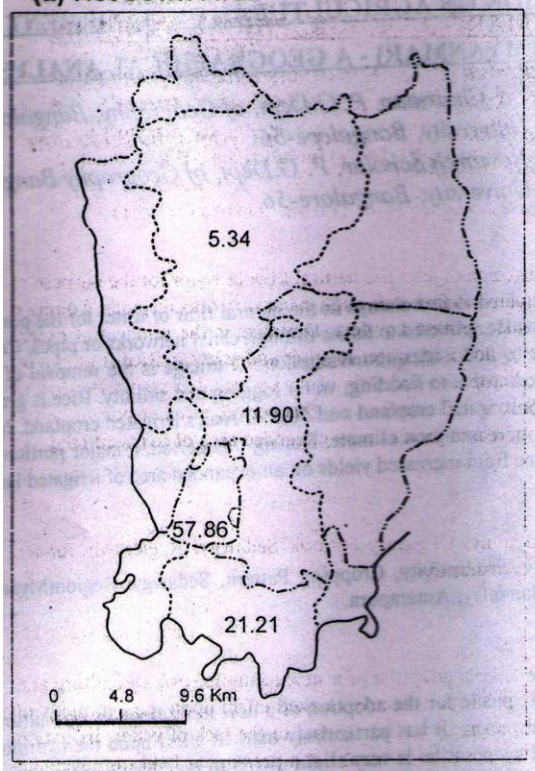
Study Area

Sedawgyi Region is located in the Dry Zone of Central Myanmar and it has total geographical area of 2,79,639 acres. It comprises four townships namely Madaya, Patheingyi, Mandalay and Amarapura, and 135 village tracts. It lies between 21° 47' and 22° 25' N latitudes and 96° 0' and 96° 20' E longitudes (Fig. I). The topography of the study area is almost plain but the undulated features can be seen on the eastern side of the Mandalay Main Canal. Because of this topographic feature, canal

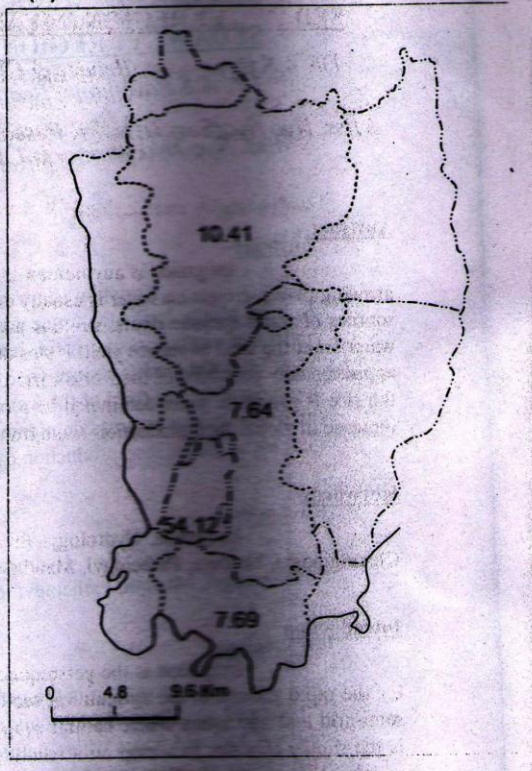
SEDAWGYI REGION

Various Indices of Coefficient of Variation

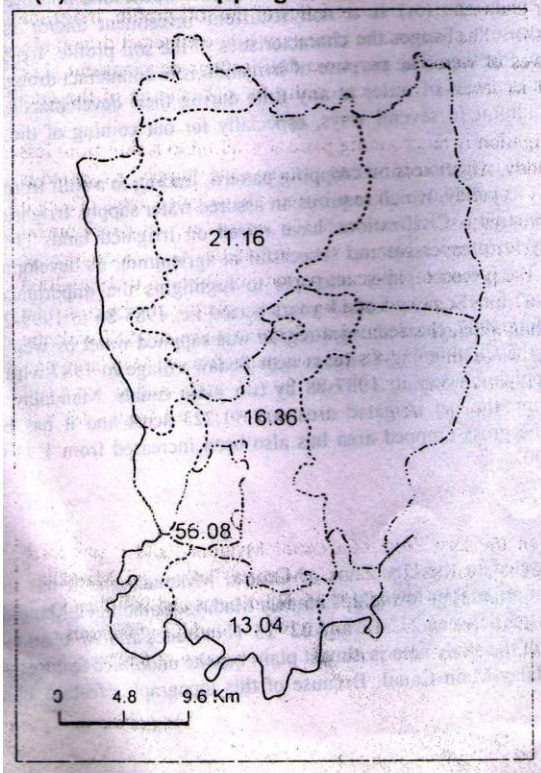
(a) Net sown Area



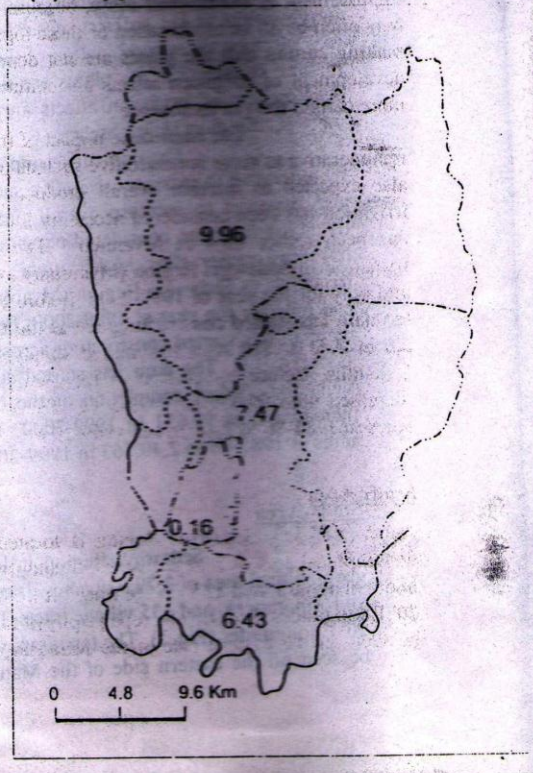
(a) Gross Cropped Area



(c) Double cropping land



(d) Supplied Water



irrigation is dominant by gravitation to irrigate the fields. About 96% of the irrigated land in the study area is supplied water by canal networks. The important river is Chaungmagyi stream, which enters the Ayeyarwady River from east side. The dam has been constructed across the head of Chaungmagyi stream. It originates on the eastern highland. The southwest monsoon is the major source to store water in the dam. December and January are the coldest months and April and May are the hottest months. The annual variation of temperature is usually more than 20 F. The average annual rainfall is 76 cm and the region is formed by the rain shadow effect of western Rakhine Range. The region belongs to the dry savanna type of climate. Mostly, alluvial soil, compact savanna soil, cinnamon soil, grey brown savanna soil and red brown savanna soil are observed in the region.

Objectives

- To know the area of scanty rainfall and how to develop irrigation in that particular area.
- To know how irrigation plays an important role in the development of agriculture in an area.
- To know how irrigation varies from one area to another
- To know the problems of irrigation facility at higher altitudes.
- To workout the correlation between irrigation and agricultural development in the region.

Sources of Data

Primary data is collected by interviewing with the farmers from 18 sample villages for the year of 1999-2000. Secondary data is collected from the government offices such as Land Record Department, Myanmar Agriculture Service, Irrigation Department, Landuse Bureau, Mandalay Division for the periods of, 1985-86 and 1999-2000.

Methodology

Based upon the availability of data, the indices of coefficient of variation have been calculated for all four townships. The formula is as follows:

$$\text{Coefficient of Variation} = \frac{\sigma X}{X} \times 100\%$$

σX = Standard Deviation of the considered variables of each township
X = Mean of the considered variable

Coefficient of variation is the percentage value of the Standard Deviation of the data set expressed a percentage of mean, i. e. it is a measure of variability, relative to the mean. The greater the percentage value is, the greater the change of this data set (variable) in respective township during the study period. In this paper, the indices of coefficient of variation have been worked out for some landuse variables such as net sown area, gross cropped area, double cropping land and supply of water for 15 years period.

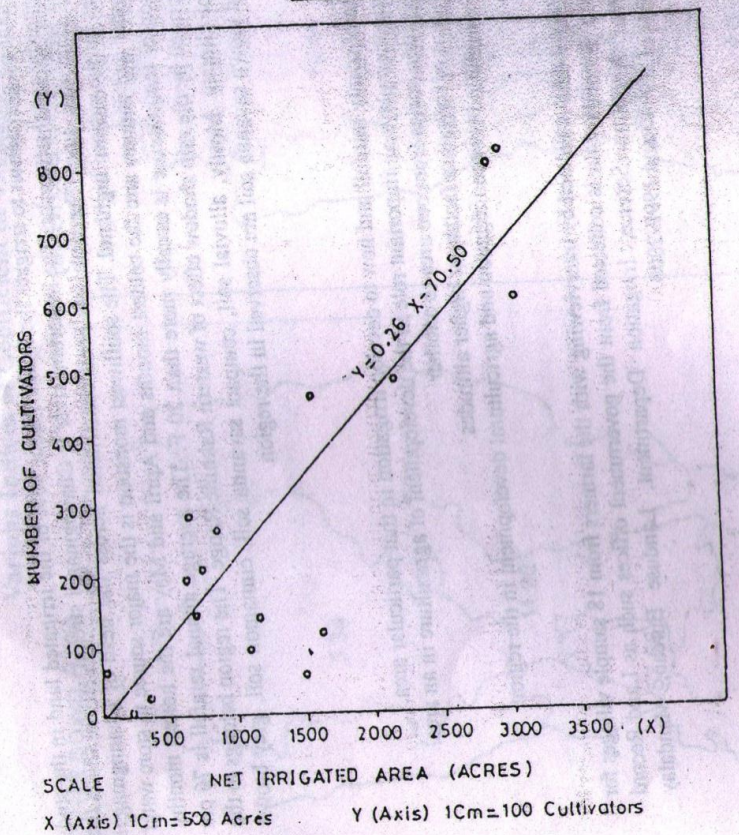
One more attempt has been made by Regression Analysis by using primary data which has been collected from grass root level of 18 sample villages. Sample villages have been selected from all four townships based on the nearness to or far from the water source. This analysis has been calculated only for the year of 1999-2000 by applying following method.

1) Karl Pearson's Product Moment Correlation Coefficient Method is used to work out the indices of correlation coefficient between two different sets of variables. The formula is as follows:

$$r = \frac{\Sigma xy - \frac{\Sigma x \cdot \Sigma y}{N}}{\sqrt{\left[\Sigma x^2 - \frac{(\Sigma x)^2}{N}\right]\left[\Sigma y^2 - \frac{(\Sigma y)^2}{N}\right]}}$$

Fig.5

REGRESSION OF NET IRRIGATED AREA AND NUMBER OF CULTIVATORS IN SEDAWGYI REGION (1999 - 2000)

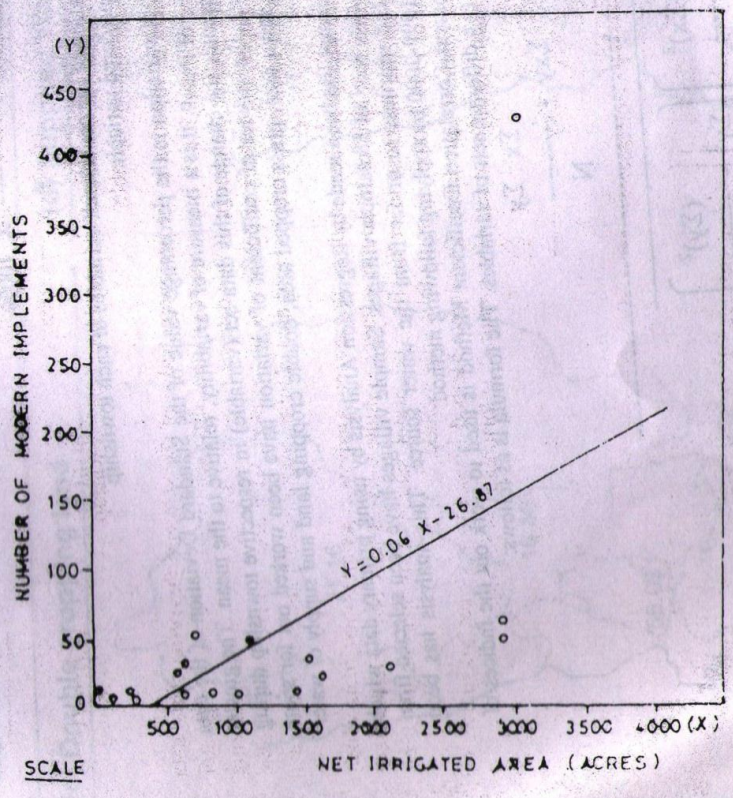


SCALE

X (Axis) 1Cm=500 Acres Y (Axis) 1Cm=100 Cultivators

Fig.6

REGGRESSION OF NET IRRIGATED AREA AND NUMBER OF MODERN IMPLEMENTS IN SEDAWGYI REGION (1999-2000)



SCALE

X (Axis) 1Cm=500Acres Y (Axis) 1Cm=50 Implements

Fig.3

REGRESSION OF NET IRRIGATED AREA AND GROSS CROPPED AREA IN SEDAWGYI REGION

(1999-2000)

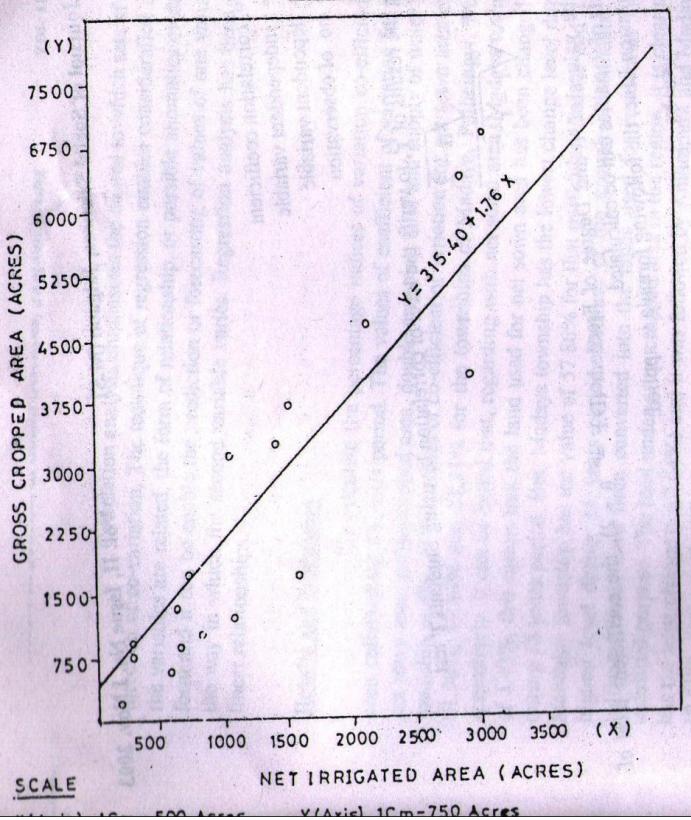
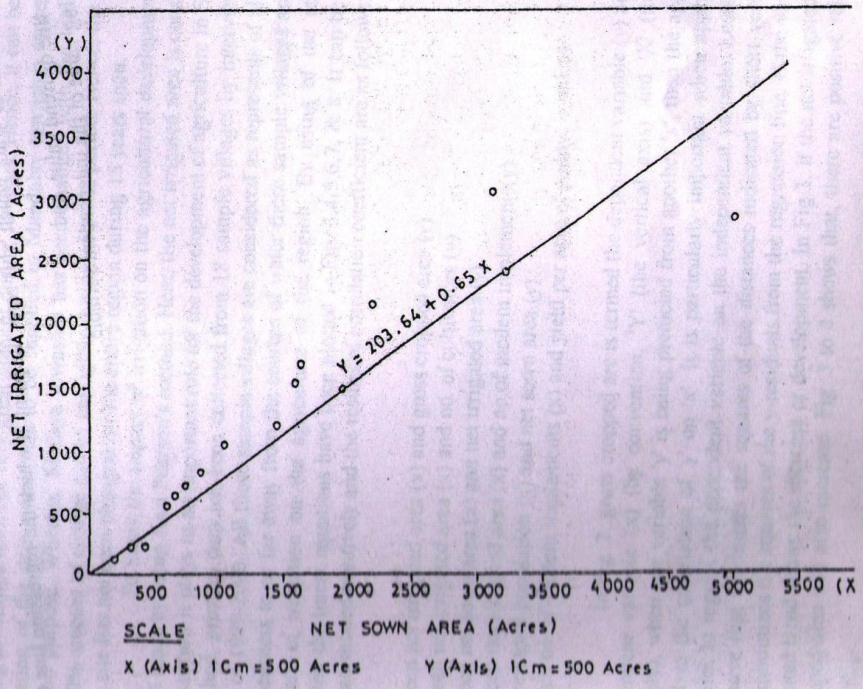


Fig.4

REGRESSION OF NET SOWN AREA AND NET IRRIGATED IN SEDAWGYI REGION (1999-2000)



Where,

r = correlation coefficient
x = independent variable
y = dependent variable
n = no. of observation

2) After observing the results of 'r', to verify the level of correlation by using Students`t' test

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

3) According to the values of 't' and Degree of Freedom (D.F = n - 2), the coefficient level of correlation of two sets of variables can be calculated.

4) To draw the Regression Line, the following formula is applied.

$$y=a+bx$$

Where,

y = the value of the dependent variable,
a = the intercept (the value of 'y' for which 'x' is zero; the point at which the regression line cuts the 'y' axis.),
b = the slope of the line or trend value, and
x = the corresponding value of the independent variable.

Correlation analysis emphasizes the degree to which sets of data vary together and the direction of co-variation. The technique of regression enables consideration of about the way in which the variables are related, the form of relationship, or possible anomalies or deviation s from the overall form and it can be enable the prediction or forecasting of values of one variable to from knowledge of the way in which the second variable varies. Regression analysis has been demonstrated by showing linear relationships.

Results and Discussion

To calculate the percentage indices of variation co-efficient, townshipwise data has been collected for 15 years period. The values of coefficient of variation for the different variables i.e. net sown area, gross cropped area, double cropping land and supply of water have been plotted in each township in Fig. 2. The values of co-efficient of variation for net sown area can be observed as 5.34%, 11.90%, 57.86% and 21.21% for the townships of Madaya, Patheingyi, Mandalay and Amarapura, respectively. It can be 'noted that, regarding with net sown area, Madaya township has least least value of 5.43%, this means that the land used for net sown area has been changed in the Sedawgyi Region during 15 years period. But, Madaya township has the lowest change level during 15 years period. But, Mandalay township has the value of 57.86% for that particular landuse and it has been changed in the highest level during 15 years period. Because of the growth of Mandalay City, almost all of the cultivated lands have been converted into the lands used for residential layouts, Govt. offices and industrial purpose. The land under gross cropped area in the region, it is clear that, Patheingyi township has the least change (i.e.7.64%) and it was followed by Amarapura and Madaya townships, 7.69% and 10.41%, respectively. Here again, the land under gross cropped area has been changed very greatly in Mandalay township during 15 years span because of its urbanization. Although the variable of supply water has been changed with the lowest level in Mandalay township i.e.0.16%, the changes for the remaining townships were not very great amount during 15 years. Hence, it can be concluded that, after construction of the dam, water has to be supplied to Mandalay township especially to the Moat for recreation purpose. Whereas, Madaya township has been changed with the highest level i.e! 9.96%, about 10% amount of change can be negligible during 15 years period. Hence, the supply of water from the dam site has not been changed for the entire region during 15 years span.

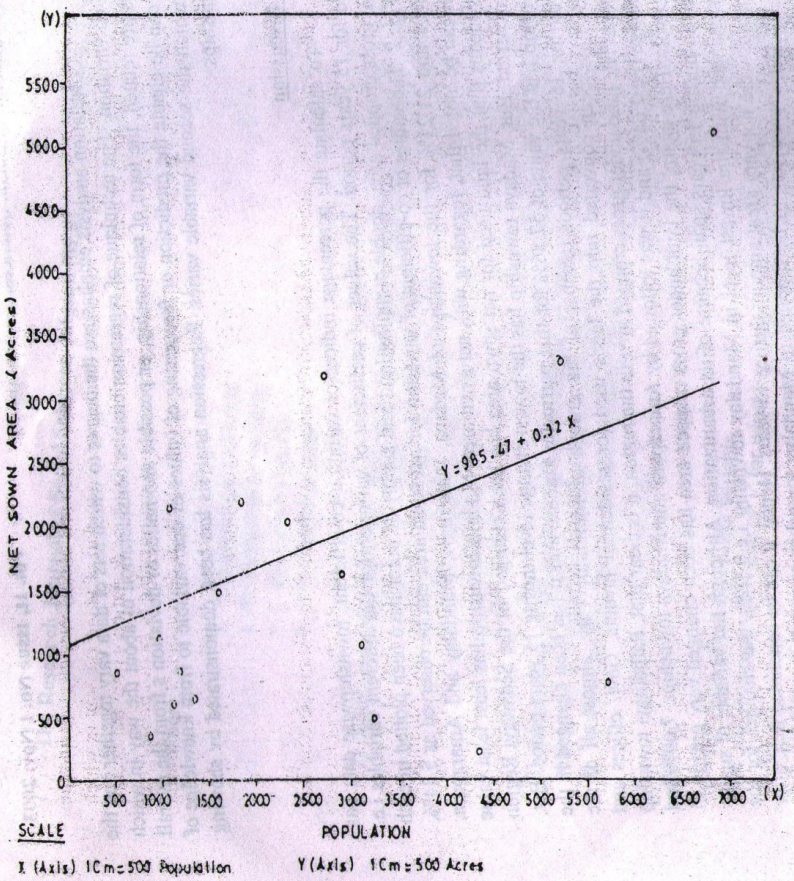
To know the impact of irrigation on the agricultural development, one more attempt has been made by using Karl Pearson's method. Here, the net irrigated area is considered as a dominant factor that how it plays in an important role for the development of agriculture in Sedawgyi Region. For this method, primary data has been collected from 18 sample villages by interviewing the farmers for the year of 1999-2000. All those sample villages are considered as represents of all 4 townships. Based on the nearness to or far away from the sources of water those sample villages are selected to observe the impact of irrigation on the agriculture of the region. By using of the results of Correlation Coefficient, the linear equations have been plotted in Fig. 3,4,5,6,7, & 8. It can be seen that, 6 pairs of data are correlated positively and the results of correlation coefficient are as follows:

(a) Between net irrigated area (x) and gross cropped area (y) : +0.87
(b) Between net irrigated area (x) and no. of cultivators (y) : +0.87
(c) Between net sown area (x) and net irrigated area (y) : +86
(d) Between net irrigated area (x) and no.of modem implements(y) : +0.58
(e) Between total population (x) and net sown area (y) : +0.48
(f) Between no. of modem implements (x) and yield per acre of paddy : +0.14

In Fig. 2, gross cropped are is termed the dependent variable (y) and net irrigated area is independent variable (x) (by convention, 'Y' (the vertical axis) and 'X' (the horizontal axis), respectively), when one variable 'y' is being predicted from another 'x', then the appropriate regression line involves the correlation of 'y' on 'x'. It is particularly important when applying the method of least-squares to regress the dependent variable on the independent variable. Least-squares regression fits the curve that minimizes the squares of the distances indicated by short vertical lines. In other words, it minimizes the squares of the y-residuals from the regression line. If the value of 'b' is positive, the correlated trend shows the increase or development. In Fig.3, if the net irrigated area increases, the gross cropped area will also increase. Fig. 3 to 8 shows that, there are positive relations between two

Fig.7

REGRESSION OF POPULATION AND NET SOWN AREA IN SEDAWGYI REGION (1999 – 2000)

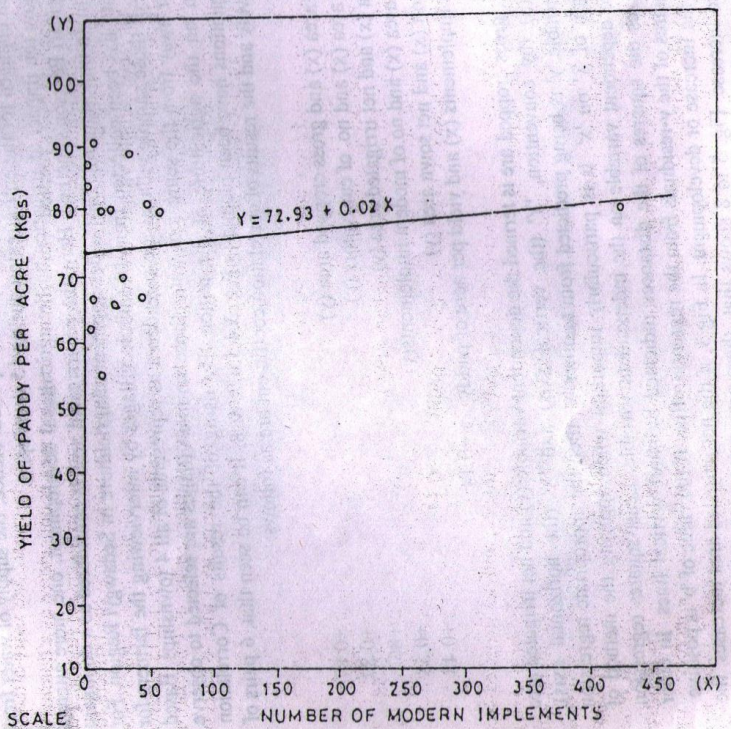


SCALE

X (Axis) 1Cm = 500 Population Y (Axis) 1Cm = 500 Acres

Fig.8

REGRESSION OF NUMBER OF MODERN IMPLEMENTS AND YIELD OF PADDY PER ACRE IN SEDAWGYI REGION (1999 – 2000)



SCALE

X(Axis) 1Cm = 50 Implements Y(Axis) 1Cm = 10 Kgs of paddy/acre

sets of data. According to Fig. 3,4,6, there are strongly effect on the respective dependent variables from the independent variables in the study are during 1999-2000.

By observing the linear equations in Fig. 3,4,5,6,7, & 8, further prediction can be made from the trend of their graphic forms. Fig. 3 shows that, the gross cropped area will be increased, if the net irrigated area is increased. And if the net sown area is increased, the net6-irrigated area will also be increased in the future. Moreover, no. of cultivators will be increased, if the net irrigated area is increased. But, modem implements cannot so much affect on the yield per acre of paddy. Because, although the farmers utilize the wooden ploughs and indigenous implements in their fields, the productivity of crops can be raised with sufficient supply of water. In Fig. 6 the usage of modem implements will be increased in future, if the net irrigated area is increased. Hence, it can be noted that the net irrigated is dominant variable for the gross cropped area, no. of cultivators and no. of modem implements. Net sown area in turn strongly correlated to the net irrigated area in Fig. 5. But, no. of modem implements cannot affect on yield per acre of paddy because, the high productivity of crops can be done by using draught animals and wooden ploughs in Sedawgyi Region. After completion of the dam, the net irrigated area has been played a vital role in the agriculture of the study area.

Conclusion

This paper reveals that the important role of the irrigation in the agricultural sector in the study region. Being as an agricultural country, Myanmar, 76% of the populations engage in agriculture. The study area is located in the dry zone of Central Myanmar, the most important physical phenomenon like temperature and topographic features are well enough for successful agriculture except moisture content. Hence, irrigation is must for the development of agriculture in the area. According to the results of two methods which have been applied in this paper, the townships of Madaya, Patheingyi and Amarapura have not been changed regarding with landuse of gross cropped area and double cropping land for the period from 1985-86 to 1999-2000. This means that, agricultural landuse has been played in an important role in the study area. But, Mandalay township has been changed in an agricultural landuse because of its urbanization and almost all cultivated land in this township has been converted into the land for residents, Govt. administrative offices and industries. Moreover, among many factors regarding with irrigation, the net irrigated area is dominant role for the gross cropped area, no. of cultivators and no. of modem implements not only for the year of 1999-2000 but for the future agricultural development in Sedawgyi Region. Therefore, this paper concludes that, major portion of canals and distributaries are unlined and a considerable quantity of water is wasted by means of seepage and evaporation in the study area. To avoid the wastage of water in the upper portion of the canals and to ensure water to tail enders, the "localization" has to be strictly adhered to. irrespective of the users. In this direction, Major portion of canals and distributaries are unlined and a considerable quantity of water is wasted by means of seepage and evaporation. This fact reveals that, all the water discharged from the canal is not available for irrigation. To avoid the wastage of water in the upper portion of the canals and to ensure water to tail-enders, the "localization" has to be strictly adhered to, irrespective of the users. Panal clauses should be introduced in order to restrict the greedy, unauthorized users. In this direction, further use of underground water can be trusted instead of investing huge amount of finance to develop canal irrigation.

After completion of the dam, the agricultural productivity has been increased because the infrastructural facilities are provided by the government such as assured supply water, providing of modem implements, etc. But, in the study area, even though water can be supplied sufficiently, there will not be developed not only for agriculture but for socio-economics of the people without considering the fixed price of crops, advanced loan money with low interest rate, pay intention to the farmers'. Besides, the fanners have been more educated and more knowledgeable, and they understood the achievements of using High Yielding Varieties of seeds, fertilizer, pesticides and modem implements. It is noted that, sufficient assured supply of water plays a vital role to improve the production of crops and in turn the economic status of the people.

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