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# PRODUCTION POTENTIAL OF SU,,"'CANE CROP IN THE PUNJAB PROVINCE OF PAKISTAN,. TO THE YEAR 2008-09

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This study focused on projecting the production potential of sugarcane crop in the Punjab province of Pakistan up to the year 2008-09. RrQduction projections were worked out by applying regression analysis on past 15 years data i.e. from 1979-80 to 1993-94, concerning area and yield of sugarcane crop. The data used in this regard were collected from various secondary sources. It emerged from the projections that if area under sugarcane crop and yield per hectare will decrease, production will decline up to the year 2008-09.

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Key words: Pakistan, production potential projection, Punjab, sugarcane crop

## INTRODUCTION

Increasing population of the world is the most revolutionary phenomenon of our times and extremely demanding challenge of the future. Like other developing countries of the world, population growth rate in Pakistan is also very high. Pakistan at present is the 8th most populous country in the world having *131.63 million* people (Anonymous, 1995-96). It had the highest annual growth rate of population i.e. 3.1% in 1994-95 which reportedly now has declined to less than.2.8%. The implications of such a rapid population growth for the future food requirements need special attention in planning and forecasting of production of various food and cash crops.

Sugarcane is one of the most important cash crops of Pakistan.dt plays a significant role in economic uplift of our farmers. It provides the principal raw material for our sugar industry as well as it meets two-thirds of the total white sugar needs. Besides white sugar, sugarcane is also utilized to produce many other by products like brown sugar, molasses, bagasse, etc. Pakistan ranks 5th in the cane acreage, 4th in cane production and 13th among sugar producing countries of the world (FAO, 1994). Punjab contributes more than 60% towards cane production in the country. In the last four decades cane production in Punjab had progressively increased from 6.96 million tonnes in 1954-55 to 47.17 million tonnes in 1994-95 (Anonymous, 1995-96).

After independence remarkable improvement in expansion of sugar industry has caused a shift in cane production and cane utilization. Over the years, sugar cane production increase in the country has come primarily from growth in area. Sugarcane crop has high requirement for irrigation water and other Inputs. The supply of required inputs has not gone hand in hand with expansion in area under sugarcane. The shortage of water in the Punjab in near future is likely to affect very severely the average area under cultivation of sugarcane. As a result it seemed imperative to carry out forecasting in respect of prospects of sugarcane crop production in Punjab up to the year 2008-09.

## METHODOLOGY

Projecting the future production potential of agricultural crops is not an easy task since it involves a large number of factors some of which are exogenous and unpredictable. In addition, data on required variables are usually lacking and incomplete. Various approaches can be employed for forecasting such as purely judgemental approaches, structural econometric models, time series models, etc. (Narappanavar, 1989; Coleman and Thigpen, 1991). Various models have been used in combination in research (Rosa, 1990; Sapsford and Varoufakis, 1990). For this study we have selected econometric technique which has been used extensively in research (Agarwal, 1990 and Khubulava, 1991). Econometric techniques have various further approaches e.g. production function, input matrices and linear programming used for projection. The application of this apparatus in developing countries may be doubtful due to certain limitations as indicated above.

There are two possible techniques to conduct a study of such a complex nature. The first technique involves working out the values of response coefficients of various inputs and thus to determine the values of marginal productivity coefficients at the farm level(Valle and Valle, 1990). The second possible technique which has been followed in this study is to use the relationship between the selected variable in the past and to project the future production potential of a commodity on the basis of past relationship between these variables. The equation was thus fitted with these variables in order to arrive at the final production projection of sugarcane.

The two variables, yield per hectare and area under sugarcane crop are the main sources of variations in production. The data for production yield per hectare and area under sugarcane were obtained from various Govt. publications. To arrive at the figures for yield per hactare and area under cultivation following algebraic equation was used: $\ln Y = a + bx$

To find out yield, log of average yield per hectare was substituted for 'LnY' and for area, log of average area was substituted, whereas "X" is the year of observations. The statistical model explains yields in terms of the passage of time and is referred to as the time series model.. Time is a proxy variable for all changes in management culture, technology and all other changes associated with the passage of time.

The production projections were obtained by multiplying the projected yield per hectare and projected area under sugarcane crop. The projected values for the production were calculated at 95 % confidence interval at n-2 degree of freedom, by the following formula:

$$\hat{Y}_f \pm t_{0.05}\, S_{yx} \sqrt{1 + \frac{1}{n} + \frac{(X-\bar{X})^2}{\sum X^2}}$$

Where $Y_f$ = projected value,

$$S_{yx} = \sqrt{\frac{\sum y^2 - \frac{(\sum Xy)^2}{\sum x^2}}{n-2}}$$

$t_{0.05}$ = Tabulated value of t at 5% level of significance, at n-2 degrees of freedom, and

n = Number of observations.

To make projections more precise and realistic certain specific assumptions have been made which are given as under:

1, Absence of exogenous disturbances such as war, social upheavals, law and order and abnormal climatic conditions.
2. It also cannot take into account the effect of unusual developments like widespread floods, viral attacks, effect of pests and disease or some other unusual circumstances.
3. The relative price structure of the agricultural commodities and agricultural policies will remain broadly unchanged during the project period.
4. The projection will take into account those measures which have already been decided upon in agricultural policy.
5. Finally the cost of inputs and price of output will generally remain the same as in the recent past.

## RESULTS AND DISCUSSION

Production projections of sugarcane crop in the Punjab. province have been worked out taking into account the variations in the area under cultivation and average yield per hectare on the basis of last 15 years i.e. 1979-80 to 1993-94 .The two variables have been projected to determine production projections of the sugarcane crop for the years to come (2008-09). The projected results are stated here under:

Area Projections: Area was projected by manipulating linear relationship between area under cultivation of sugarcane and number of years by using the equation:

$$\ln(Y) = 21.7 - 0.00773\ X$$

Area under sugarcane cultivation is predicted to decrease from 523.64 thousand hectares in 1994-95 to 503.81 thousand hectares in 1999-2000,484.97 thousand hectares in 2004-05 and 469.94 thousand hectares in 2008-09 (Table 2). An apparent reason for the fall in area appears the shift over from sugarcane to cotton and rice in the Punjab, since farmers expected a higher return from these crops as their prices were getting closer to the international prices.

Yield Projections: Average yield projections per hectare were made by applying the equation:

$$\ln(Y) = 2.33 + 0.00299\ X$$

Based on the past trends, the average yield/hectare indicated a nominal increasing trend. From 1994-95 to 1999-2000, average yield per hectare would increase from 36.10 t/ha to 36.64 t/ha in 2004"05 and 37.64 t/ha in 2008-09 (Table 2). The projected increase in the average yield per hectare will be negatively compensated by the nominal decrease in area under sugarcane and hence will not bring any

Table 1. Past production ,area and yield/ha of svgereane crop in Punjab

| Year | Area (000 ha) | Yield (t/ha) | Production (000 t) |
|---|---|---|---|
| 1979-80 | 501.4 | 38.7 | 19413.5 |
| 1980-81 | 597.5 | 39.7 | 23733.0 |
| 1981-82 | 670.2 | 37.3 | 25021.0 |
| 1982-83 | 628.3 | 33.2 | 20882.4 |
| 1983-84 | 613.7 | 37.2 | 22835.9 |
| 1984-85 | 626.1 | 33.5 | 2d959.0 |
| 1985-86 | 510.6 | 32.8 | 16755.1 |
| 1986-87 | 487.2 | 37.9 | 18477.7 |
| 1987-88 | 535.3 | 36.3 | 19406.2 |
| 1988-89 | 529.6 | 36.8 | 19493.7 |
| 1989-90 | 501.0 | 37.3 | 18682.9 |
| 1990-91 | 525.6 | 37.4 | 19633.4 |
| 1991-92 | 536.2 | 37.3 | 20026.8 |
| 1992-93 | 536.1 | 37.4 | 20044.8 |
| 1993-94 | 596.2 | 41.1 | 24510.0 |

significant change in the total production. A lack of adequate seed supply and time old farm practices that are otherwise mandatory to obtain high yield are among the main reasons for low yield per hectare as compared to other sugarcane producing countries.

Production Projections: Future production estimates were arrived at by using the equation:

$$Ln(Y)= 19.4 \quad 0.00479\ X$$

On the basis of last 15 years yield and area, it was projected that production would -fall from 21234.9 thousand tonnes in 1994-95 to 20733.4 thousand tonnes in 1999-2000, 20241.7 thousand tonnes in 2004-05 and 19858.8 thousand tonnes in 2008-09, showing thereby a declining trend in future( Table 2). The decrease in production projections of sugarcane in the Punjab is ascribed to the fall in average yield per hectare and area under cultivation. Thus expected future increase in production of sugarcane appears to be directly related to the expansion in hectareage and rise in average yield per hectare.

Conclusions: It appears that total cultivated area has increased as a result of changes in cropping pattern, higher cropping intensity, increased demands in sugar industry leading to higher returns to the farmers, better marketing facilities, reclamation of land and conservation programme and various other government efforts to promote agriculture production. On the other hand, certain factors such as waterlogging, low yield, intensive labour requirement, high demand for inputs, cultivation of sunflower, floods, heavy rains, etc. contributed towards low average yields in some parts of the province.

The analysis of the past yield trend manifests that there has not been significant break through in average yield per hectare. However, a rising trend in yield during some periods was due to the use of improved hybrid varieties of sugarcane, increased water supply through installation of tubewells, proper water management practices, increased use of fertilizer, plant protection measures and increased and stabilized demand for sugarcane from the sugar industry. But the. last decade witnessed a gloomy picture which may be attributed to non-availability of input resources, credit facilities, poor management of ratoon crop, propagation of low yielding sugarcane variety, etc. Such an evidence reflects negative trends in sugarcane production. Thus the country might be facing scarcity of sugar in the near future as there will be less supply than the aggregate demand. To be more specific the production of sugar during the last 15 years has grown only at the rate of one percent a year against the population growth of nearly 3%. If the existing level continues, the country would need to import sugar at an increasing rate every year.

Suggestions: The analysis of the available input constraints and the presentplanting practices indicate

Table 2. Forecasted area, yield and production of [illegible] in [illegible]

| Year | Forecasted area ('000 ha) | | | Forecasted yield (t/ha) | | | Forecasted production ('000 t) | | |
|---|---|---|---|---|---|---|---|---|---|
| | S.O.C.I* | S.C.I** | | S.O.C.I | S.C.I | | S.O.C.I | S.C.I | |
| | | Lo. | Up. | | Lo. | Up. | | Lo. | Up. |
| 1994-95 | 523.64 | 46[illegible] | 586.[illegible] | 36.10 | 33.73 | 38.63 | 21234.9 | 18803.5 | 23983.0 |
| 1995-96 | 519.62 | 458.[illegible]3 | 588.98 | 36.21 | 34.07 | 38.48 | 21135.4 | 18940.1 | 23576.6 |
| 1996-97 | 515.64 | 449.71 | 591.17 | 36.31 | 34.39 | 38.34 | 21034.1 | 19074.4 | 23192.9 |
| 1997-98 | 511.63 | 441.11 | 593.4[illegible] | 36.[illegible]2 | 34.70 | 38.23 | 20933.4 | 19187.2 | 22833.4 |
| 1998-99 | 507.25 | 432.95 | 59[illegible] | 36.53 | 34.98 | 38.15 | 20833.1 | 19323.9 | 22033.1 |
| 1999-2000 | 503.81 | 424.20 | 598.31 | 36.64 | 35.23 | 38.10 | 20733.4 | 19323.9 | 22245.6 |
| 2000-01 | 499.9 | 415.92 | 600.88 | 36.75 | 35.43 | 38.11 | 20634.1 | 19323.9 | 220[illegible] |
| 2001-02 | 496.05 | 407.8[illegible] | 603.47 | 36.86 | 35.57 | 38.19 | 20535.3 | 19264.1 | 21890.3 |
| 2002-03 | 492.26 | 399.81 | 606.07 | 36.97 | 35.64 | 38.34 | 20437.0 | 19[illegible] | 21822.6 |
| 2003-04 | 488.48 | 391.94 | 608.75 | 37.08 | 35.66 | 38.56 | 20339.1 | 18956.[illegible] | 21824.7 |
| 2004-05 | 484.69 | 384.21 | 611.49 | 37.1[illegible] | 35.62 | 38.84 | 20241.7 | 18726.6 | 21881.6 |
| 2005-06 | 480.97 | 376.61 | 614.25 | 37.30 | 35.[illegible]4 | 39.16 | 201[illegible]4.8 | 18464.4 | 21980.3 |
| 2006-07 | 477.28 | 369.18 | 617.02 | 37.42 | 35.53 | 39.51 | 2005[illegible] | 18182.2 | 22108.1 |
| 2007-08 | 473.57 | 361.84 | 619.86 | 37.52 | 35.31 | 39.88 | 19[illegible] | 17886.5 | 22259.0 |
| 2008-09 | 469.94 | 354.67 | 622.66 | 37.64 | 35.17 | 40.28 | 19858.8 | 17583.2 | 22428.8 |

* [illegible] confidence interval; ** [illegible] confidence interval.

that the cane and sugar yield can considerabl¥,~. increased by bringing improvements in soil, qr~.nd water management practices. The strat'~· and policy measures for cane yield improvemeJ'l(;j,.e linked with the following resource developmert~:

a. For optimum management of lanqand crop, a comprehensive input resource package *like* facilitating liberal credit to small farmers, managing cane fields, assuring irrigation water, and facilitating effective plant protection services must be guaranteed.

b. A 'quality research particularly in the areas of cane breeding, sugarcane mechanization, stress technology and Intercropping needs to be effectively undertaken.

c. Government should formulate comprehensive policies by specifically imparting incentives for production of quality cane, strengthening the cane. grower's cooperative societies, cane development councils and a sugarcane research institute. A creditable agricultural extension service is equally important.

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