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DISPARITIES IN FOODGRAINS PRODUCTION IN UTTAR PRADESH : A SPATIO-TEMPORAL ANALYSIS

T. C. Sharma and O Coutinho, Belgaum

ABSTRACT : This study, carried out with the aims of analysing the spatial patterns of the growth, and the disparities resulting due to it in the production of foodgrains in the State of Uttar Pradesh in the recent years, reveals that most of the increment to foodgrains production has come from the rise in the yield of cereals in the western districts. The disparity in the yields is much greater presently than in the past and irrigation is the most important factor responsible for it. The authors have strongly argued in favour of expanding the irrigation base in the southern and eastern districts, where most of the State's unrealised potential in agricultural production lies, due to lack of it.

India's new agricultural strategy built around the High-Yielding Varieties Programme since the mid-sixties has not yielded so far the production boom that was expected due to it. It is often made out that the programme has failed owing to : (i) non-availability so far of suitable new seeds in millets and pulses which are raised mainly rainfed, (ii) the high cost of modern inputs required for the HYVs in crops like wheat and paddy; and (iii) the overwhelming dependence of the programme on assured moisture supply. The progress, as a result, is highly disperate spatially and sectorally. It has, however, been brought out in a number of sample surveys carried out by the Indian Council of Agricultural Research recently that the single most important factor behind the slow and disperate growth is the 'input differential' (IASRI, 1974-75) which alone can explain the extreme yield variations even under generally similar physical and cultural conditions under both types of technologies. It is also now agreed generally that India's food production can be raised many-fold if the input application level and cultural practices can be improved for which the scope is considerable not only in the low growth pockets but even in the areas generally rated higher (Bhatia, 1981; Sarup and Pandey, 1981).

An attempt has been made in the present exercise : (i) to analyse empirically the growth of foodgrains production since 1966-67, (ii) to decompose the components of production increase between 1966-67 and 1980-81, (iii) to measure the yield variation over time and space,, (iv) to measure the yield gap between the various levels of practices and to correlate the gap with certain well-known controls for 1980-81 in the State of Uttar Pradesh to focus on the yield disparity and potential available in this state.

METHODOLOGY

The growth in foodgrains production is measured by fitting to the index numbers (based on triennium ending 1968-69 for the period exponential functions of the Type $Y = a + bX$, where Y is the index number and X is the time in log linear form $\text{Log } Y = \log^2 A + X \log B$. Compound growth rate = (antilog b-1).100.

The additive effect of the three physical components, area, yield and their interaction, is measured using the formula $\Delta Q = Ao \ \Delta Y + Yo \Delta A + \Delta A \ \Delta Y$ where $\Delta Y = Yn - Yo$ $\Delta A = A - Ao$ and $\Delta Q = Qn - Qo$, with Ao, Yo and Qo representing the area, yield and production in the base year and An, Yn and Qn in the current year. The first, second and third terms on the right side of the equation represent yield, area and interaction effects respectively.

The yield variation between the districts for all the 15 years is measured with the help of the formula $CV = \frac{\sigma}{X} . 100$.

The yield gap is defined as the percentage of yield potential unrealised. It is worked out using the formula $I(Yg) = \frac{P(fy) - A(fy)}{P(fy)} \times 100$ where I (Yg) = index of yield gap. P (fy) = yield rate in the best practice district during the last triennium of the study period and A (fy) = yield of the crop in the other districts. The index of potential realisation is obtained by subtracting the index of yield gap from 100 as index of yield gap + index of potential realisation = 100.

Multiple regression technique has been used to measure the factors responsible for the existing yield-gap by taking the index of potential realisation as the dependent variable. The explanatory variables included in the analysis are percentage area under irrigation, size of land holdings, per hectare consumption of fertiliser* and rainfall index $\frac{\text{(actual rainfall during the year)}}{\text{normal rainfall}} \times .100$. The model used for the analysis is as follows:

$Y = f(X_1, X_2, X_3, X_4)$ where Y = index of potential realisation X_1 = irrigated crop per cent; X_2 = land holdings' size X_3 = rainfall index; and X_4 = fertiliser consumption in kg per hectare; e = error term.

GROWTH IN PRODUCTION

Uttar Pradesh is the largest foodgrain producing state in India, her annual output being over 2.45 crore tonnes or 16-17 per cent of India's total production. The state leads all the others in both cereals and pulses. However her yield rates in spite of a 136.09 per cent increase during 1966-68 to 1978-80 period remains only around the national average and much below the yield in states like Punjab and Haryana.

During the study period foodgrains production in Uttar Pradesh rose by nearly 145 per cent (at 2.87 per cent per annum). The entire increment came from cereals and mostly due to a sharp rise (2.78 per cent per annum) in their hectare yield. The pulses' area declined sharply (at 2.86 per cent per annum) and their yield marked only a marginal increase. A comparison of the growth rates in the irrigated proportion of the 3 groups showed that the cereals' area was rapidly brought under assured irrigation (5.81 per cent per annum), whereas pulses registered a decline in the irrigation provision which was small in any case. The increased irrigation to cereals helped in bringing more areas under HYVs and gave a boost to the yields. As a result, wheat and paddy, the

* Since the per hectare consumption for foodgrains is not available, the amount for all crops in a district is used for the purpose here.

two prime performers in the new strategy, now occupy over half of the total cropped area in the state. Unless pulses provide a higher economic return – which is unlikely in the near future – their cultivation will be replaced by wheat, paddy and sugarcane. In almost all the high irrigation tracts, this pattern has already emerged as dominant.

The spatial patterns of growth within the region are also explainable in terms of the increase in yield which in turn is linked closely with the increase in irrigation. The highest increase (76 per cent per annum) was recorded in Nainital (Plains) and the two neighbouring districts, Shahjahanpur and Pilibhit; and 18 other districts, Dehradun, Saharanpur, the 5 districts between Bulandshahr and Bareilly; Kanpur, Kheri and the 9 districts forming a tract between Allahabad and Deoria had a medium growth (of 3.2 to 5.18 per cent per annum). The yield rate, however, still remains very low in several of these districts, particularly in Ghazipur, Kheri and Azamgarh. The growth was low (0.2 – 2.86 per cent per annum) in the remaining 26 districts occupying most of the central and southern parts. The group includes the several high-yield Doab districts where the scope for further rise in yield appears reduced and a large number of low-yield districts in the eastern and southern parts where lack of irrigation appears to be the main constraint. Jhansi district recorded a decline.

COMPONENTS OF PRODUCTION GROWTH

Production increased in the State mainly due to rise in yield (80.06 per cent) and area-expansion and the interaction effects contributed to it only marginally (14.55 per cent and 5.25 per cent respectively). In only a few districts, Mirzapur, Fatehpur and Bahraich, area-expansion contributed substantially (above 30 per cent) to the increase and in most others, particularly in the high-yield western districts, its share was in fact negative due to shifts in favour of non-food cash crops particularly sugarcane. The shifts were obviously from the pulses area.

SPATIAL AND TEMPORAL VARIABILITY IN YIELDS

Though the yield rates in foodgrains registered an increase in all districts, the growth was highly disparate and, as a result, inter-district variation in it was higher during the last triennium (CV 27.03 per cent) as against CV 25 per cent during the first triennium. A comparison of the in-between years indicated that : (i) the spatial disparity rose sharply in the drought years, for example 1967-68 and 1979-80 (CV 30.33 per cent and 38.15 per cent respectively), the extent of crop failure being greater in the low irrigation development districts, (ii) the pulse crops had a greater degree of disparity (CV 26.84 and 45.07 per cent respectively) than the cereals group (CV 24.43 and 27.45 per cent respectively) (iii) temporally, the yields showed a much lower variation in the two tracts with extremely high and low yields than in the medium-yield tracts, and (iv) there was also no significant difference between the variation in the yields of cereals and pulses, due perhaps to a rapid rise in the yield rates in the former and annual fluctuations in the later.

YIELD GAP

The average yield rate of foodgrains in Uttar Pradesh currently is about 1,206 kg per hectare which, though higher than the national average (1.032 kg), is much lower than the rates in Punjab (2.458 kg), Haryana (1.597 kg), Kerala (1.587 kg), West Bengal (1.358 kg) and Tamil Nadu (1,340 kg). Farm experiments conducted by the Indian Council of Agricultural Research recently suggest that the yield in the State can be raised to a much higher level than the present rates in most of the foodgrain crops and that the unutilised yield potential in the State is over 60 per cent. Even if the yields could be raised to the level in the best practice district, the State's production can be doubled from its present level.

The yield rate in the State currently varies from as low as 668 kg in Bahraich to as high as 2,003 kg in Nainital (Plains). The Upper Ganga-Yamuna Doab districts from Saharanpur to Bulandshahr, Nainital (Plains), Pilibhit, Rampur and Kanpur enjoy the highest yield rate currently (1.558 – 2.003 kg) obviously the potential for further rise in the yield in this tract under the present conditions is only limited, about 25 per cent in the 7 districts besides districts in western Uttar pradesh; Hardoi, Unnao, Lucknow, Barabanki, Bareilly, Fatehpur, Rae Bareli, Faizabad, Allahabad and the 6 districts to its north-east upto Deoria have a medium yield (1,113 kg – 1.558 kg) and potential (25-45 per cent). The lowest yield in the State currently (668.1.113 kg) and, therefore, a high potential (45-67 per cent) prevails in the southern belt of districts from Jhansi to Mirzapur; in the northern belt from Kheri to Basti and in Ballia, Faizabad and Sultanpur. This pattern in the current yield and potential-yield appears to be closely related to the area under low-yield crops like coarse cereals and pulses which in turn appears to be controlled by several other physical and cultural factors.

The regression analysis indicated that about 78 per cent of the variability in yield rates or yield potential realised in foodgrains and 71 per cent in cereals was due to the effect of per cent-area of the crop-group irrigated, fertiliser consumption per hectare, and size of land holdings. Irrigation stands out as the most important function with a coefficient value of 0.67 in foodgrains and 0.77 in cereals. Fertilizer consumption ranks next with a coefficient of 0.29 for foodgrains but insignificant for cereals, indicating that it is more even in the state. Rainfall showed a positive impact on the yield-gap in the case of pulses, all the other factors playing only an insignificant role in the yield rates or growth potential realisation of this group, showing clearly that the group remains neglected in terms of modern inputs.

CONCLUSIONS

The study reveals that almost the entire increase in foodgrains production in Uttar Pradesh took place due to rise in the yields of cereals. The pulses area declined sharply and it was chiefly responsible for the decline in their production. It shows that the yields in the southern and eastern districts have not increased much and still remain at a very low level. The yield-rate in the western and northwestern districts has, on the contrary, risen very sharply. As a result, the disparity in the yields is presently greater than in the mid-sixties, indicating that the new farm technology has had little impact on the agriculture in the former area and that it has widened the development-gap between these regions.

Irrigation emerges as the most important amongst the four factors affecting the yield patterns which are included in the analysis. The study indicates that a certain amount of breakthrough is evident in all parts of the state but non-availability of irrigation acts as a severe constraint and unless this impediment is removed, many parts of the state particularly the entire Bundelkhand and many districts of Gorakhpur, Faizabad, Varanasi and Lucknow divisions will not be able to realise the huge yield potential which remains untapped. A large area is still covered under low-yield coarse grains and pulses in these parts and their yield rates, even in wheat and paddy, are low.

The study also shows that unless the yields improve, pulse crops will be eliminated from the state's cropping patterns in the years to come.

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ADDRESSES OF THE AUTHORS
Dr. T. C. Sharma
Department of Geography
Rani Parvati Devi College, Belgaum

Dr. O. Countinho
Department of Geography
Rani Parvati Devi College, Belgaum