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Food and Population: Priorities in Decision Making

Report of a Meeting
of the International
Conference of Agricultural
Economists, Nairobi, August 1976.

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Achieving a balance between population and food: the Indian case

V.M. Dandekar

The purpose of the present paper is to review briefly the growth of population and the expansion of food production in India in the past quarter century and to assess the prospects of achieving a balance between population and food in the near future. It will be evident that, in spite of vigorous official action on both fronts, namely population and food, a balance between the two is by no means in sight.

Population—food balance in the past

In Table 1 are given the basic data for 1951 to 1974. It shows, for each year, the estimated population, the estimated output of foodgrains, net imports of foodgrains, and changes in stocks of foodgrains held by the government. A simple calculation gives the estimated supplies of foodgrains to the public. There would also be stocks in the hands of the public and changes in them from year to year as producers, traders, and consumers would all build up stocks in good years and carry them into the next year; and, in a bad year, withdraw from the previous stocks. No estimates are available of changes in stocks with the public. We should suppose that in years in which the production is much below the normal, the stocks would be low. In particular, we shall assume that at the end of 1952, 1953, 1958 and 1967, the stocks in public hands were near zero and that at the end of 1974, they were very small. On this basis, the average *per capita* consumption, including all uses such as human consumption, seed, animal feed and wastage, amounted to 181.80 kgs. *per capita* per annum between 1954 and 1958; 184.87 kgs per annum between 1959 and 1967; and 188.0 kgs per annum between 1968 and 1974. The estimated changes in stocks in public hands, on the assumption that the *per capita* annual consumption between 1954 and 1958 was in fact 181.80 kgs, between 1959 and 1967 in fact 184.87 kgs and between 1968 and 1974 in fact 188.0 kgs, are given in column 7 of the table. These are of course hypothetical but they are not implausible. For instance, it may be noted that the maximum stocks with the public (at the end of 1965, fully unloaded in 1966 and 1967) constituted about 20 per cent of the supplies of foodgrains with the public during the year. This amounts to carrying less than two-and-half months' requirements from one year into the next and should be quite normal. It is possible, therefore, that the actual *per capita* annual consumption during 1954–58, 1959–67, and 1968–74 was in fact about 181.80 kgs, 184.87 kgs, and 188.0 kgs, respectively.

Table 1
Population—food balance

<i>Year</i>	<i>Population (million)</i>	<i>Output of foodgrains (million tonnes)</i>	<i>Net imports (million tonnes)</i>	<i>Changes in government stocks (million tonnes)</i>	<i>Foodgrains supplies with the public (million tonnes)</i>	<i>Hypothetical changes in stocks with the public (million tonnes)</i>	<i>Per capita onsumption (kgs)</i>
(1)	(2)	(3)	(4)	(5)	(6)=(3)+(4)-(5)	(7)	(8)
1951	363.211	55.011	4.801	+ 0.589	59.223	—	163.05
1952	369.231	55.603	3.926	+ 0.618	58.911	—	159.55
1953	375.633	61.784	2.035	— 0.483	64.302	—	171.18
1954	382.438	72.326	0.832	+ 0.202	72.956	+ 3.427	181.80
1955	389.668	70.739	0.513	— 0.746	71.998	+ 1.155	181.80
1956	397.334	69.335	1.372	— 0.602	71.309	— 0.928	181.80
1957	405.450	72.457	3.620	+ 0.856	75.221	+ 1.509	181.80
1958	414.021	66.629	3.210	— 0.269	70.108	— 5.163	181.80
1959	423.052	78.803	3.851	+ 0.492	82.162	+ 3.951	184.87
1960	432.543	77.120	5.119	+ 1.403	80.836	+ 0.871	184.87
1961	442.372	82.326	3.486	— 0.165	85.977	+ 4.195	184.87
1962	452.212	82.397	3.629	— 0.355	86.381	+ 2.780	184.87
1963	462.027	80.330	4.536	— 0.022	84.888	— 0.528	184.87
1964	472.132	80.699	6.252	— 1.243	88.194	+ 0.910	184.87
1965	482.530	89.367	7.439	+ 1.063	95.743	+ 6.537	184.87
1966	493.209	72.347	10.311	+ 0.137	82.521	— 8.660	184.87
1967	504.162	74.231	8.659	— 0.260	83.150	—10.056	184.87
1968	515.414	95.052	5.671	+ 2.035	98.688	+ 1.790	188.00
1969	526.986	94.013	3.824	+ 0.462	97.375	— 1.698	188.00
1970	538.881	99.501	3.547	+ 1.116	101.932	+ 0.622	188.00
1971	550.822	108.422	2.010	+ 2.568	107.864	+ 4.309	188.00
1972	562.467	105.168	—0.498	— 4.694	109.364	+ 3.620	188.00
1973	574.216	97.026	3.587	— 0.309	100.922	— 7.031	188.00
1974	586.056	103.611	4.827	— 0.456	108.894	— 1.285	188.00

Source: Bulletin of Food Statistics 1975. Directorate of Economics and Statistics, Ministry of Agriculture & Irrigation, Government of India, New Delhi.

We may neglect the very low *per capita* consumption in the early years of 1951, 1952 and 1953. Even if we do that and consider the situation since 1954, there is a clear evidence of a certain, though a small, improvement in the *per capita* consumption of foodgrains. It increased from 181.80 kgs in 1954 to 188.0 kgs in 1974, which is an increase of about 3.4 per cent over a period of 20 years. This came about partly because of increased production and partly increased imports. The position is summarised in the following:

<i>Period</i>	<i>Production</i>	<i>Net imports net of change in govt. stocks</i>	<i>Consumption</i>	<i>Column (3)/(4)</i>
<i>(1)</i>	<i>(2)</i>	<i>(kgs per annum per capita)</i> <i>(3)</i>	<i>(4)</i>	<i>(%)</i> <i>(5)</i>
1954–58	176.72	5.08	181.80	2.795
1959–67	172.33	12.54	184.87	6.785
1968–74	182.31	5.77	188.00	3.070

Thus, in 1954–58, 2.8 per cent of the consumption was supported by imports. The improvement in the *per capita* consumption in 1959–67 was entirely due to increased imports; production of foodgrains *per capita* declined from 176.62 kgs in 1954–58 to 172.33 kgs in 1959–67 and imports were increased from 5.08 kgs in 1954–58 to 12.54 kgs *per capita* in 1959–67. The imports supported 6.8 per cent of the consumption in 1959–67. The improvement in 1968–74 was almost entirely due to increased production though *per capita* imports were also somewhat higher than in 1954–58. Compared to 1954–58, the level of *per capita* consumption in 1968–74 was higher by 6.20 kgs. Of this, 5.59 kgs was contributed by increased production and 0.069 kgs by increased imports.

Targets and prospects for food supply

The Draft Fifth Five Year Plan (1974–79) has proposed a target of 140.0 million tonnes of foodgrains in 1979. The projected population in 1979 is 636.8 million. This gives an output of 219.85 kgs of foodgrains *per capita* which is more than enough to achieve a balance between population and food. In fact, it seems that at the level of development and *per capita* consumption envisaged in the Fifth Plan, 200.0 kgs of foodgrains *per capita* should be adequate for the purpose. In the following, we shall examine the prospects of achieving this in the near future.

The targets of food production envisaged in the Fifth Plan were much influenced by the record production in 1971, namely, 108.4 million tonnes. Consequently, the Planning Commission estimated that the output of foodgrains in 1974 would be 114.0 million tonnes and targeted the output in 1979 to be 140.0 million tonnes. The estimate of 114.0 million tonnes in 1974

has turned out to be very much an overestimate; the actual production in that year was 103.6 million tonnes. Moreover, an increase from an assumed 114.0 million tonnes in 1974 to 140.0 million tonnes in 1979 is an increase of 22.8 per cent which is equivalent to an annual rate of growth of 4.1 per cent. This is a growth rate in the production of foodgrains never achieved in the past over any period of five years, including the period of the new strategy of agricultural production based on high-yielding varieties of foodgrains and intensive application of water and fertilisers. Both the potential and the limitations of the new strategy have now become evident. The chief inputs are the research in high yielding varieties and pests and diseases to which they are liable; irrigation water and fertilisers. The high yielding varieties have to be extended and new varieties have to be continually developed. Except for sheer good luck, the progress in this matter cannot be more rapid than in the past few years. Expansion of irrigation is both expensive and inevitably a slow process. The world-wide oil crisis and consequent rise in the prices of fertilisers have caused new problems in the supply of and expansion of use of fertilisers. A large part of agriculture in India is still at the mercy of the monsoon and the output is liable to wide fluctuations from year to year. Because of these circumstances, a more realistic assessment of future prospects should be based on the whole experience of the past two decades.

In Table 1, we have already presented the estimates of output of foodgrains from 1951 to 1974. The increase in the output in the initial years up to 1954 was largely due to expansion of cultivation of which there is little possibility any more. Hence, to assess the future prospects, it is advisable to consider the period beginning with 1954. The annual rate of growth obtained by fitting an exponential curve to the estimated output from 1954 to 1974 turns out to be 2.13 per cent ($r^2 = 0.74969$). There are four years in which the actual output deviates from the exponential trend by a large magnitude: in 1958, 1966 and 1967, the output was exceptionally low; in 1971, the output was exceptionally high. The four years illustrate the vagaries of the monsoon; but they are not useful in determining the growth rate over a period. If we omit them, the annual growth rate turns out to be 2.08 per cent with greatly improved coefficient of determination ($r^2 = 0.94128$). We are inclined to accept this growth rate for assessing the future prospects of food production.

In Table 2, along with the estimates of actual output of foodgrains are given the estimates of the trend output determined by fitting an exponential curve to the data for 17 years from 1954 to 1974 omitting 1958, 1966, 1967 and 1971. As mentioned above, the annual growth rate so determined is 2.08 per cent. Also given are the deviations of the actual output from the trend output expressed as percentage of the latter. It will be noticed that except in the omitted years, the deviations of the actual output are more or less within 5 per cent of the trend output. In the omitted years, the deviations are of course much larger. In 1958, 1966 and 1967 the actual output fell below the trend output by 11.5, 18.5 and 18.1 per cent respectively; in 1971, the output was above the trend output by 10.2 per cent.

Table 2
Exponential trend fitted to output of foodgrains, 1954–74
(omitting 1958, 1966, 1967 and 1971)

<i>Year</i>	<i>Output of food- grains (million tonnes)</i>	<i>Exponential trend output (million tonnes)</i>	<i>Deviation of actual output as per cent of trend output</i>
1954	72.326	69.328	+ 4.324
1955	70.739	70.770	– 0.044
1956	69.335	72.241	– 4.023
1957	72.457	73.743	– 1.744
1958	66.629	75.277	– 11.488
1959	78.803	76.842	+ 2.552
1960	77.120	78.440	– 1.683
1961	82.326	80.070	+ 2.818
1962	82.397	81.735	+ 0.810
1963	80.330	83.435	– 3.721
1964	80.699	85.170	– 5.250
1965	89.367	86.941	+ 2.790
1966	72.347	88.748	– 18.480
1967	74.231	90.594	– 18.062
1968	95.052	92.477	+ 2.784
1969	94.013	94.400	– 0.410
1970	99.501	96.363	+ 3.256
1971	108.422	98.367	+ 10.222
1972	105.168	100.412	+ 4.736
1973	97.026	102.500	– 5.340
1974	103.611	104.631	– 0.975

Annual rate of growth = 2.08 per cent ($r^2 = 0.94128$)

Earlier it was suggested that an output of 200.0 kgs *per capita* would be adequate to achieve a balance between population and food. If a trend output of 200.0 kgs is reached, we may expect that in all years, except the very bad years which might occur once in seven or eight years, the actual output will be above 190.0 kgs *per capita* and that would be adequate to achieve the balance between population and food. In Table 3, the trend output is projected for 1981 and 1986. In parallel columns are given estimates of projected population and projected output of foodgrains *per capita* of the projected population. Thus it will be seen that even in 1986, that is ten years hence, the *per capita* output will barely reach the level of 190.0 kgs, provided the population does not grow faster than is projected. It is obvious, therefore, that the growth rate of output of foodgrains derived from the trend in the past 21 years since 1954, namely 2.08 per cent, will prove

Table 3
Projected population and output of foodgrains

<i>Year</i>	<i>Population</i> <i>(million)</i>	<i>Output of</i> <i>foodgrains</i> <i>(million tonnes)</i>	<i>Output of</i> <i>foodgrains per capita</i> <i>(kgs)</i>
1974	586.056	104.631	178.53
1981	657.329	120.843	183.84
1986	705.200	133.940	189.93

inadequate to achieve a balance between population and food even in 1986. For this purpose, the growth rate of output of foodgrains must be immediately stepped up to at least 2.52 per cent per annum. Taking the trend output of 104.6 million tonnes in 1974 as the base, if the output grows at 2.52 per cent per annum, it will reach 141.0 million tonnes in 1986 which, with the projected population of 705.2 million, gives 200.0 kgs *per capita*. A growth rate of 2.52 per cent per annum in the output of foodgrains is not impossible but, judging by the past experience, is not easy and cannot certainly be taken for granted. Much greater effort in the expansion of irrigation and fuller utilisation of available water will be needed. While efforts on the agricultural front are thus intensified, sustained efforts must be made to ensure that the population in 1986 is no more than the projected 705.2 million.

Population growth

In Table 4 are given decennial estimates of population of India for 70 years from 1901 to 1971 and also estimates of crude birth and death rates for the several decades. It will be seen that India did not have much of a population problem until 1921. In the two decades, 1901–1921, the population grew by only 5.4 per cent. But, since 1921, as a result of a gradual improvement of the medical and health services, the death rates began to fall without a corresponding fall in the birth rate. In the three decades, 1921–1951, the death rate fell by about 20 per thousand but the birth rate fell by only 8 per thousand. In consequence, the population increased by 11 per cent in 1921–31, by 14.2 per cent in 1931–41; and by 13.3 per cent in 1941–1951. Thus, in 1951, India already had a recognisable population problem on her hands.

In 1951, India entered the era of planned economic development and, as an essential and integral part of that process, rapidly expanded her medical and public health services. As a result, the death rate declined rapidly, from 27.4 per thousand in 1951 to 22.8 per thousand in 1961, to 15.1 per thousand in 1971. On the other hand, the birth rate declined by only 2.7 per thousand, from 39.9 per

Table 4
Trends in population, birth and death rates in India

Year	Population (million)	Decadal growth (%)	Annual growth (%)	Rate per annum per 1000		
				Crude birth	Crude death	Natural growth
1901	238.337	} 2.67	0.26	—	—	—
1911	252.005			49.2	42.6	6.6
1921	251.239			48.1	47.2	0.9
1931	278.867	11.10	1.05	46.4	36.3	10.1
1941	318.539	14.23	1.34	45.2	31.2	14.0
1951	360.950	13.31	1.26	39.9	27.4	12.5
1961	439.073	21.64	1.98	41.7	22.8	18.9
1971	547.950	24.80	2.24	37.2	15.1	22.1

Source: Pocket Book of Population Statistics, Registrar General of India, Census Centenary, 1972.

thousand in 1951 to 37.2 per thousand in 1971. In consequence, the population increased at an unprecedented rate of 1.98 per cent per annum between 1951 and 1961 and at 2.24 per cent per annum between 1961 and 1971. Thus the process of economic development greatly accelerated population growth and seriously aggravated the population problem.

In 1951, the Government of India enunciated the official policy on population and explicitly recognised the need to reduce the birth rate along with the decline in the death rate; but it mainly relied on the 'natural' methods of contraception, namely, abstinence and rhythm. In 1956, a major change in policy occurred; sterilisation was officially accepted and an active programme of family planning was initiated. The programme is now well established. It is an entirely voluntary programme actively supported by extension education and persuasion. In the service centres, all effective methods of contraception are made available for the individual to choose from. These include the conventional contraceptives such as the condoms, diaphragms, jelly/cream and foam tablets; the intra-uterine device (IUD) and finally sterilisation of the male (vasectomy) and of the female (tubectomy). Acceptors of IUD and sterilisation are offered small monetary incentives partly to cover the incidental costs and partly to compensate possible loss of wages for a few days because of forced rest.

By the end of March 1975, the estimated number of married women of reproductive age effectively protected from conception was as shown on page 126. The number of married women of reproductive age (15–44) in March 1975 is estimated to be 102.2 million. Of these, 14.97 million, that is 14.6 per cent, were effectively protected from conception. It will be seen that sterilisation has proved

	<i>Number of women of reproductive age (15-44) (million)</i>
Sterilisation	12.533
IUD	1.223
Conventional contraception	1.215
	<hr/>
Total	14.971
	<hr/>

to be the main instrument of protection from conception; it accounts for 83.7 per cent of the contraceptive protection provided in March 1975. The balance is equally divided between IUD and the conventional contraceptives.

Population prospects

The population projections accepted by the Planning Commission in the Draft Fifth Five Year Plan are based on the following assumptions regarding decline of birth, death and growth rates in the coming decade:

<i>Year</i>	<i>Birth rate (per thousand of population)</i>	<i>Death rate</i>	<i>Growth rate</i>
1973-74	35.57	15.23	20.34
1978-79	29.57	12.81	16.76
1983-84	24.82	11.14	13.68

Thus it is expected to bring down the birth rate by 1.2 per thousand on an average every year in the first quinquennium 1973-74 to 1978-79 and by 0.95 per thousand on an average every year in the second quinquennium from 1978-79 to 1983-84. On this basis the birth rate is estimated to decline to 26.69 per thousand in 1981-82 and to 22.09 per thousand in 1986-87.

The birth rate during 1951-61 was estimated to be about 40.0 per thousand and we might take this to be the level of birth rate prior to the initiation of the family planning programme. As we have seen, as a result of the operation of the family planning programme over 20 years from 1956 to 1975, 14.6 per cent of the married women of reproductive age were contraceptively protected in March 1975. If the protected women were evenly distributed among different categories of women with different levels of fertility, the contraceptive protection of 14.6 per cent of the women would bring down the birth rate by about 14.6 per cent, that is by about 5.86 per thousand (14.6 per cent of 40.0 per thousand). In fact, a majority of the protected women are found to have three or more living children. Taking into account the distribution of women according to the number of living

children and the live-birth order-specific fertility rates, it seems that the contraceptive protection of 14.6 per cent of the married women of reproductive age would cause a decline of about 4.89 per thousand in the birth rate. We may generalise this and say that, to cause a decline of one per thousand in the birth rate, three per cent of the married women of reproductive age must be contraceptively protected.

The implications of this for the future family planning programme are as under:

	<i>1981-82</i>	<i>1986-87</i>
Targeted birth rate per thousand	26.69	22.09
Decline per thousand from the pre-family planning level of 40.0 per thousand	13.31	17.91
Per cent of married women of reproductive age that must be protected	39.93	53.73
Estimated population at the beginning of the year in million	657.329	705.200
Estimated number of married women of reproductive age (172 per thousand of population) in million	113.061	121.294
Number of married women of reproductive age that must be contraceptively protected at the beginning of the year in million	45.145	65.171

In short, while in March 1975, only 14.97 (say 15.0) million married women of reproductive age were contraceptively protected, this number will have to be raised to 45.145 (say 45.0) million in March 1981 and further to 65.171 (say 65.0) million in March 1986. This will require immediate expansion, more than doubling, of the family planning programme. The computational details are shown in Table 5.

In Table 5, column (2) gives the number of married women of reproductive age that must be protected at the end of each year. Column (3) gives the addition to this number each year. Besides this additional number, the number of protected cases which become inoperative each year will have to be replaced. This is estimated in column (4) assuming that 5 per cent of the protected cases at the beginning of each year become inoperative during the course of the year. This is approximately correct in the case of sterilisation which becomes inoperative only in the event of death or widowhood of the mother or her reaching the end of her reproductive period, namely, age 45. In the case of IUD insertion, the proportion becoming inoperative each year is much higher, estimated to be about 30 per cent, because, in addition to the above mentioned circumstances, allowance has to be made for the removals and expulsion of the IUD. We may neglect it because, as we have seen, sterilisation accounts for over 80 per cent of the contraceptive protection presently provided. This proportion is likely to increase in future. Column (5) which is the total of columns (3) and (4) thus gives the number of

Table 5
Family planning programme for the decade: 1975–76 to 1985–86

<i>Year</i>	<i>Number of women to be protected at year end</i>	<i>Additional number of women to be protected</i> <i>(figures in million)</i>	<i>Replacement of inoperative cases</i>	<i>Total number of new women to be protected during the year</i>
(1)	(2)	(3)	(4)	(5) = (3)+(4)
1974–75	15.00			
1975–76	20.50	5.50	0.750	6.250
1976–77	25.80	5.30	1.025	6.325
1977–78	30.90	5.10	1.290	6.390
1978–79	35.80	4.90	1.545	6.445
1979–80	40.50	4.70	1.790	6.490
1980–81	45.00	4.50	2.025	6.525
1981–82	49.40	4.40	2.250	6.650
1982–83	53.60	4.20	2.470	6.670
1983–84	57.60	4.00	2.680	6.680
1984–85	61.40	3.80	2.880	6.680
1985–86	65.00	3.60	3.070	6.670

women which will have to be given new protection each year. This number is 6.25 million in 1975–76, gradually rises to 6.68 million in 1984–85 and gradually declines thereafter.

To judge the feasibility of achieving these targets, one should examine the performance in the past. Though the programme was actively initiated in 1956, it picked up only after 1966. The progress in vasectomies was particularly impressive. But after reaching a peak of 2.6 million vasectomies in 1972–73, it suddenly collapsed. Vasectomy is amenable to mass campaigning. This was done on a large scale in 1971–72 and 1972–73 with added financial incentives. It showed some immediate results but, for good reason, the practice was given up. The number of vasectomies performed in 1974–75 was only 608,000. In comparison, the progress in tubectomies has been slower but steadier. The number of tubectomies performed in 1971–72, 1972–73, 1973–74 and 1974–75 are 567,000, 509,000, 539,000 and 720,000, respectively. Tubectomy appears to be preferred to even the IUD insertion. In fact, after a promising start, the IUD seems to have lost ground, reportedly because of numerous post-insertion complaints. Since 1971–72, the number of tubectomies has steadily exceeded the number of IUD insertions.

Thus it seems that sterilisation by vasectomy and tubectomy will remain the main item in the family planning programme in the immediate future. In 1972–73,

the Family Planning Programme in India performed over 3.0 million cases of vasectomy and tubectomy. With some strengthening, it may be able to perform over 6.0 million cases each year.

The crucial question is whether the targets can be achieved under a voluntary programme as it operates at present. It may be noted that a reduction in the birth rate from a pre-family-planning level of 40.0 per thousand to 22.1 per thousand in 1986–87 is a reduction of 44.8 per cent. It means that of the births ordinarily occurring in a year, about 45.0 per cent must be prevented. Of the live births occurring in a year, it is estimated that about 45.0 per cent occur to mothers who already have three or more living children. Hence, the programme must aim at sterilising all mothers, or their husbands, who have three or more living children. It is doubtful whether this can be done, at any rate for some years to come, under a purely voluntary programme. It is not without reason that serious consideration is being given to making sterilisation legally compulsory for all couples having three or more living children, in spite of certain obvious dangers and difficulties of compulsion.

Conclusions

In spite of the serious efforts being made by the Government of India on both fronts, it seems that balance between population and food is not easy to reach much before 1986. Even to reach it in 1986, the efforts on both fronts will have to be further intensified. The rate of growth of production of foodgrains in the past two decades has been only 2.08 per cent per annum. It must be stepped up to at least 2.52 per cent per annum. This is not impossible but cannot be taken for granted. On the population front, the family planning programme must be expanded to perform at least 6.0 million sterilisations every year. The aim must be to sterilise all married women of reproductive age, or their husbands, who already have three or more living children. If this cannot be achieved by education and persuasion under a voluntary programme, compulsion may have to be contemplated.

It is thus obvious that the battle will have to be fought on both fronts — food and population. Fortunately, the two programmes are operationally independent and they do not compete for the same real resources. It is also evident that, in the process of economic development, the two programmes will mutually strengthen each other. Hence, both the programmes can and must be pursued simultaneously and vigorously. Between the two, the family planning programme is presumably capable of a more rapid expansion because the real-resource constraint on this programme is less rigid than in the case of expansion of food production.