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INVESTMENT ON AGRICULTURAL RESEARCH IN GUJARAT

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The 17th session of the Conference of FAO that was held in November, 1973 gave recognition to the need for more agricultural research activities in the developing economies and recommended that expenditure for research and development should attain a minimum average level equivalent to ½ per cent of their gross national product. Funding levels for research activities in the developing countries, specifying needed levels of resource allocation for agricultural research, depend on budgetary allocation of funds from Government.

It is therefore necessary to study the allocation and utilization of agricultural research expenditure on various crops and to study whether the research expenditure is incurred in a rational manner in consonance with the state and national policies, priorities and needs. Research for the sake of research is a luxury that developing countries like ours cannot afford. Confronted with the many serious problems in agricultural development, the developing countries are more in need of efficient and workable tools that can guide them in allocating resources for agricultural research. Two of the goals that can be expected of the national development programmes in India in general and Gujarat State in particular are self-sufficiency in food and a more equitable sharing of economic gains. An attempt is made in this paper to study the allocation of funds in crop research in the State of Gujarat. The economy of Gujarat State is dominated by agriculture, wherein agriculture contributes about one-half to the State income. Secondly, the agricultural economy of the State is also dominated by cash crops to the extent of two-thirds of its contribution to agricultural income. Gujarat State has to attain stable self-sufficiency in its foodgrains requirements without disturbing much the dominance of cash crops like cotton, sugarcane, tobacco, groundnut, etc., in its cropping pattern. Therefore, a systematic analysis and planning would be useful in making rational decisions about the allocation of funds for agricultural research.

AGRICULTURAL RESEARCH IN GUJARAT

The principal food crops in Gujarat State are wheat, rice, pulses and millets while oilseeds, cotton, tobacco and sugarcane are the main cash crops. Cash crops have become important for the economy of the State. They have also led to a measure of integration of agriculture and industries. Gujarat State is well ahead in crop improvement and seed development programme in India. Official efforts for seed improvement and development work in Gujarat date back at least to the early years of this century especially since 1936, by

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evolving improved variety of cotton, namely, 1927 A.L.F. at Agricultural Research Station, Surat. For crop research main research stations have been established with regional and sub-stations according to soil and climatic conditions and research need of the crop in the agro-climatic zones. Prior to the establishment of Gujarat Agricultural University, agricultural research activities were being looked after by the State Department of Agriculture and Institute of Agriculture, Anand. The Government of Gujarat transferred all these research activities along with research stations to the Gujarat Agricultural University on 1st June, 1972. Research activities in the Gujarat Agricultural University include, at present, mainly applied research problems pertaining to agriculture and allied sciences with inter-disciplinary approach. This includes research in crop improvements on cereals, millets, pulses, cotton and other fibre crops, tobacco, oilseeds, sugarcane, vegetable and horticultural crops, spices, medicinal plants and fodder crops. The University is also collaborating with the Indian Council of Agricultural Research (ICAR) in co-ordinated research projects on millets, cereals, oilseeds, cotton, sugarcane, water use, dry farming, soybean, tobacco, potato, medicinal plants, forage crops, biological control, animal nutrition, reproductive biology, etc. There are 71 agricultural research stations and Taluka-cum-Demonstration Farms with the Gujarat Agricultural University, scattered all over the State.

INVESTMENT IN AGRICULTURAL RESEARCH AND GROWTH OF AGRICULTURE IN GUJARAT

Gujarat has a cultivable area of about 100 lakh hectares and the Gujarat Agricultural University is spending about 38 per cent of its total budget on research of which one-third is coming from outside agencies like ICAR, and other agencies. During 1973-74, the Gujarat Agricultural University spent Rs. 96.10 lakhs on research in agriculture, animal husbandry and allied fields. An analysis of expenditure on ten important crops of the Gujarat State during 1973-74 has been made on unit expenditure basis. Table I provides data on area, production, gross value of the crop and research expenditure on these crops. Table II presents unit research expenditure in paise per hectare, per tonne and per 100 rupees worth of crop value. Table III provides data on area, production and productivity of crops during the Plan periods.

Foodgrains

Gujarat State is facing food shortage compared to the requirements of the population in the State. During 1973-74, the production of cereal crops was 33 lakh tonnes whose money value amounted to Rs. 337 crores. Cereals were grown on 40 lakh hectares of land. The money spent for research on cereals was about Rs. 19 lakhs. Thus, on an average, the research money spent on a hectare of cereal crops is 47 paise as compared to Rs. 5.32 for tobacco and Rs. 11 for sugarcane. On the basis of unit of production of cereals,

TABLE I—AREA, PRODUCTION, GROSS VALUE AND RESEARCH EXPENDITURE OF IMPORTANT CROPS OF GUJARAT STATE FOR 1973-74

Sr. No.	Crop	Area			Production		Average yield (kg./hectare)	Gross value of the crop		Research expenditure	
		Hectares	Per cent of cultivated area	Rank	Tonnes	Rank		Lakh rupees	Rank	Rs.	Rank
1.	Bajra	18,26,300	17.93	2	13,12,400	2	719	13,587	3	5,12,400	4
2.	Sorghum	10,00,800	9.83	4	4,31,700	6	431	5,186	6	3,26,700	8
3.	Paddy	4,46,200	4,38	6	4,67,900	5	1,049	5,885	5	6,13,000	3
4.	Wheat	5,21,400	5.12	5	9,05,900	4	1,737	11,201	4	3,61,400	7
5.	Maize	2,58,500	2.54	8	1,93,600	8	749	1,879	10	76,400	10
6.	Pulses	4,20,500	4.13	7	1,65,200	9	393	2,400	9	1,58,000	9
7.	Oilseeds	17,96,700	17.64	—	13,59,600	—	752	23,783	—	8,69,300	2
	(*a*) Groundnut	15,81,600	15.83	3	12,41,400	3	785	20,646	2	—	—
	(*b*) Sesamum	1,03,300	1.01	9	30,900	12	299	768	12	—	—
	(*c*) Castor	57,100	0.56	11	56,000	11	983	1,239	11	—	—
8.	Cotton	18,63,300	18.30	1	16,12,800	1	156	46,610	1	15,50,500	1
9.	Sugarcane	44,400	0.43	12	2,22,700	7	5,016	3,942	7	4,89,100	5
10.	Tobacco	90,609	0.89	10	1,31,000	10	1,446	3,369	8	4,81,900	6

Source: Gujarat Agricultural University: Budget Books and Department of Agriculture, Gujarat State, Ahmedabad.

TABLE II—UNIT RESEARCH EXPENDITURE IN GUJARAT

Sr. No.	Crop	Rank			Unit expenditure in paise per			Research expenditure as per cent of gross value of crop
		Area	Production	Crop value	Hectare	Tonne	Rs. 100 worth of crop value	
1.	Bajra	2	2	3	28	39	3.8	0.038
2.	Sorghum	4	6	6	33	76	6.3	0.063
3.	Paddy	6	5	5	137	131	10.4	0.104
4.	Wheat	5	4	4	69	40	3.2	0.032
5.	Maize	8	8	10	30	39	4.0	0.040
	All cereals	—	—	—	47	57	5.0	0.050
6.	Pulses	7	9	9	37	96	6.6	0.066
	Foodgrains	—	—	—	46	59	5.1	0.051
7.	Oilseeds	3	3	2	48	64	3.6	0.036
8.	Cotton	1	1	1	83	96	3.3	0.033
9.	Sugarcane	10	7	7	1,100	219	12.4	0.124
10.	Tobacco	9	10	8	532	368	14.3	0.143

TABLE III—AREA, PRODUCTION AND PRODUCTIVITY OF FOODGRAINS, OILSEEDS, COTTON AND TOBACCO IN GUJARAT DURING FIVE-YEAR PLANS

Area in '00 hectares
Production in '00 metric tonnes
Productivity in kg./hectare

Sr. No.	Plan period	Unit	Food-grains	Oil-seeds	Cotton	Tobacco
1.	First Five-Year Plan (1951-52 to 1955-56)	Area	55857	11926	13719	604
		Production	18748	4397	8343*	412
		Yield/hectare	333	362	107	679
2.	Second Five-Year Plan (1956-57 to 1960-61)	Area	49801	18993	17501	809
		Production	20282	11065	10566*	559
		Yield/hectare	407	586	108	692
3.	Third Five-Year Plan (1961-62 to 1965-66)	Area	47962	23437	17566	859
		Production	25787	13577	14388*	826
		Yield/hectare	538	581	147	963
4.	Average of Three Annual Plans (1966-67 to 1968-69)	Area	51897	21612	16888	906
		Production	28113	11311	14620*	929
		Yield/hectare	539	522	155	1026
5.	Fourth Five-Year Plan (1969-70 to 1973-74)	Area	49931	19229	17967	881
		Production	37089	13071	17434*	1132
		Yield/hectare	735	676	175	1,288
6.	1974-75	Area	38175	17019	15955	885
		Production	21528	5519	13739*	1274
		Yield/hectare	564	324	155	1,440
7.	1975-76	Area	50173	18839	17775	786
		Production	45198	21727	15839*	1166
		Yield/hectare	891	1,153	160	1,483

* Bale of 180 kg. lint.
Source: Department of Agriculture, Gujarat State, Ahmedabad.

research expenditure is 57 paise per tonne of cereals produced and for every 100 rupees value of the cereal crops, 5 paise is spent on research. Thus the crop value-wise research expenditure on cereals is 0.05 per cent. Pulses were grown over an area of about 4 lakh hectares and pulses production amounted to 1.65 lakh tonnes. The economic value of the pulse crops was estimated to be Rs. 24 crores. The total research expenditure on pulses was Rs. 1.6 lakhs. This shows that research expenditure for pulses is 37 paise per hectare, 96 paise per tonne and 6.6 paise for 100 rupees worth of pulse crop, which amounts to 0.066 per cent. Research expenditure on bajra and jowar works out to 28 paise and 33 paise per hectare, respectively. Wheat is a staple food for the people of Gujarat. The total area under wheat was about 5 lakh hectares, its production being 9 lakh tonnes valued at Rs. 112 crores in 1973-74. Research expenditure on wheat crop amounts to 69 paise per hectare, 40 paise per tonne and 3.2 paise per 100 rupees worth of crop which amounts to 0.032 per cent. This is rather a low investment in research for such an important crop. Research expenditure

on paddy crop amounted to Rs. 1.37 per hectare, Rs. 1.31 per tonne and 10.4 paise per 100 rupees worth of paddy, which comes to 0.10 per cent.

From the data in Table III it appears that the total area under foodgrains has more or less settled around 50 lakh hectares, while the production has increased from 18.7 lakh tonnes during the First Plan to 37 lakh tonnes during the Fourth Plan on account of intensification of agricultural research. The all-India linear rate of growth of production and productivity (1960-61 to 1972-73) of foodgrain crops is 2.52 per cent and 1.74 per cent respectively, while the same for Gujarat is as high as 7.97 per cent and 6.77 per cent respectively, the difference in growth rate between all-India and the State amounting to more than 5 per cent. However, the picture of average yield per hectare in Gujarat as compared to the all-India average and other States is not satisfactory. Bajra being an important staple crop of the State, its average yield in the State is 719 kg./ha. as compared to 1,100 kg./ha. in Punjab. The average yield of pulses in the State is 400 kg./ha. as compared to the all-India average yield of 531 kg./ha., 1,024 kg./ha. in Haryana and 841 kg./ha. in Punjab. The average yield of jowar is 431 kg./ha. in Gujarat, as compared to 786 kg./ha. in Tamil Nadu, 799 kg./ha. in Orissa and the all-India average of 522 kg./ha. Wheat is a staple food for the people of Gujarat; its average yield works out to 1,737 kg./ha. as compared to 2,084 kg./ha. for Haryana and 2,220 kg./ha. for Punjab. Paddy is also another important crop of the State, where the average yield of paddy is 1,049 kg./ha. as compared to the all-India average of 1,073 kg./ha., 1,425 kg./ha. for Andhra Pradesh, 1,539 kg./ha. for Haryana, 1,329 kg./ha. for Kerala, 2,070 kg./ha. for Mysore, 1,400 kg./ha. for Punjab, 1,682 kg./ha. for Tamil Nadu and 1,266 kg./ha. for West Bengal. There seems to be a need for intensifying research on paddy to obtain higher yields. The average yield of total cereals comes to 817 kg./ha. and for foodgrains 777 kg./ha. as compared to the all-India average of 909 kg./ha. for cereals and 821 kg./ha. for foodgrains. Pulses are important as a regular item of food and source of protein for most of the population of Gujarat. There is obvious need to increase the yields of pulse crops by introducing high-yielding varieties and other measures. Maize has greater potentiality as a food crop and for industrial purposes. There is scope for boosting yields of cereal crops and pulses in the State by intensifying agricultural research. Uptill now, all the research funds are spent on research related to production of crops, but now attention has to be paid to post-harvest technology and multi-disciplinary approach for about 10 per cent of crops is lost due to improper handling, processing, storage and transportation.

Cotton

Gujarat is the foremost State in India in cotton production and known for the textile industry. The State has nearly 18 lakh hectares of area under cotton and produces nearly 16 lakh bales of lint annually. This accounts for about 22 per cent of the total area and about 31 per cent of the total produc-

tion of cotton in the country, thus ranking second in cotton acreage but first in the production of cotton. Gujarat has a proud record of varietal improvement in cotton. It produces more than 50 per cent of the country's medium staple cotton, nearly 30 per cent of superior long staple cotton and about 59 per cent of the extra-long staple cotton. Gujarat farmers produced cotton worth Rs. 466 crores from which an additional annual income of Rs. 15.16 crores is earned by the cotton growers of the State by growing improved varieties of cotton. The rate of growth of production and productivity of cotton at the all-India level and in Gujarat is 0.76 per cent and 2.2 per cent and 0.99 per cent and 2.57 per cent respectively. The State has taken a lead in the evolution and commercialisation of hybrid cotton by evolving Hybrid-4. Research expenditure on cotton is 83 paise per hectare, 96 paise per tonne and 3.3 paise per 100 rupees worth of cotton, which comes to only 0.033 per cent.

Oilseeds

Oilseed crops include groundnut, sesamum, castor, etc. Groundnut occupies a prominent place amongst oilseeds. Gujarat State stands first amongst all States in India in area under and production of groundnuts. Gujarat accounts for about 20 per cent of the total annual production in the country. However, having regard to the yield per hectare, the position of Gujarat is not quite satisfactory. The yield per hectare in Gujarat being 752 kg. is below the all-India average of 840 kg. and lower than the per hectare yield in other States, *e.g.*, 983 kg. in Andhra Pradesh, 1,357 kg. in Orissa, 1,051 kg. in Tamil Nadu and 1,047 kg. in Kerala. Oilseeds were grown on 18 lakh hectares in Gujarat and oilseeds production amounted to 13.60 lakh tonnes valued at Rs. 238 crores. Research expenditure on oilseeds is 48 paise per hectare, 64 paise per tonne and 3.6 paise per 100 rupees worth of the crop, which comes to 0.036 per cent. Research efforts should be concentrated to increase the per hectare yield of groundnut. In view of the economic importance of the crop to the State, the amount of research funds provided is very inadequate. Secondly, the feasibility of growing new oilseed crops of soybean and sunflower should also be studied.

Tobacco

Gujarat State is one of the leading States in India in respect of tobacco production. This has considerably benefited the cultivators. The tobacco development activity is intensified by supplying disease-free seedlings and adoption of improved technology. It is grown on 90,000 hectares producing 1.30 lakh tonnes worth Rs. 34 crores. The annual production of tobacco crop was of the order of 0.41 lakh tonnes during the First Plan which increased in the successive Plan periods and reached 1.30 lakh tonnes in 1973-74 as a result of increase in productivity. The growth rate of production of tobacco in Gujarat is three times higher than that of all-India and its

rate of growth of productivity in the State is as high as 4.15 per cent as against only 0.51 per cent at the all-India level. Research expenditure on tobacco is about Rs. 5 lakhs, giving unit research expenditure of Rs. 5.32 per hectare, Rs. 3.68 per tonne and 14.3 paise per 100 rupees worth of produce, which comes to 0.14 per cent being the highest as compared to other crops. It has still to develop superior varieties and technologies especially post-harvest technology.

Sugarcane

Gujarat State is not producing sugarcane in sufficient quantities to meet its requirements of *gur* and sugar. Sugarcane was grown on 44,400 hectares with a production of 2.23 lakh tonnes in 1973-74, having an average yield of 5,000 kg./ha. and a crop value of Rs. 39 crores. Research expenditure on sugarcane is about Rs. 5 lakhs, which amounted to Rs. 11 per hectare, Rs. 2.19 per tonne and 12 paise per 100 rupees worth of the crop, which comes to 0.12 per cent. Unit research expenditure on this crop is higher than other crops due to smaller acreage of the crop and higher production. However, the growth rate of productivity of sugarcane in the State is—0.34 per cent.

Research expenditure incurred in Gujarat in 1973-74 for different crops is given in Table II. Research expenditure varies from 0.03 to 0.14 per cent of the gross value of the crop. It is generally advocated that research expenditure should be ½ per cent of the gross value of a crop, meaning thereby that it should be 50 paise per 100 rupees worth of a crop. The data in Table II reveal that investment in crop research in Gujarat is very inadequate. More funds should be provided for research on bajra, wheat, maize, pulses and oilseeds. The figures of unit expenditure on sugarcane and tobacco are on the higher side. Thus there is urgent need to rationalise research expenditure in relation to the State and national goals of agricultural development, policies and priorities. A major goal of agricultural research in consonance with the State and national objectives of agricultural development is higher and more stable yields. Agricultural research should aim at bringing about a continuous rise in the economic yield of crops per unit area, time and water, without detriment to the long-term productiviy of the soil. In addition, research should also help to increase the efficiency of farming, as reflected by the return a farmer gets from his investment on inputs.