RESEARCH EXPENDITURE IN THE INTERNATIONAL AGRICULTURAL RESEARCH CENTRES

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The number of International Agricultural Research Centres (IARCs) supported by the CGIAR has expanded considerably since the Consultative Group was formed in 1971. The financial requirements of the centres are increasing rapidly and there will likely be recurring shortfalls in donor support in the near future. Thus it is becoming more important to develop a rational system of resource allocation to the different centres. This will not be a simple task, especially as each centre is responsible for deciding on the level of financial support it will request for its own research programs.

Different criteria, such as the potential payoff from centre research in each crop program, the amount and kind of research undertaken elsewhere, the level of expected food deficits of each of the different food crops, and the significance of food crops in the developing countries should be considered before establishing program priorities.

The purpose of this analysis is to examine the latter criterion: the significance of different food crops in the developing countries. The attached tables measure the relationship between IARC expenditure on the different IARC crops and livestock and their significance in terms of area cultivated, production and contribution to diet in the developing countries.

Certain assumptions had to be made about actual centre expenditure on individual crops where the centres did not provide a breakdown. However, the assumptions dealt with magnitudes not significant enough to more than marginally affect the results.

Table I indicates the allocation of IARC funds to the different IARC crops and livestock in 1974 and 1975, and, as projected, to 1976 and 1979. Table II shows the area cultivated, dry weight production and centre expenditure on livestock and each of the three main crop categories. Table III provides a breakdown of IARC expenditure for each of the crops

within each main crop category and the production and area cultivated of each of these crops in the developing countries (LDCs).

Table IV provides a similar breakdown for the twenty-five least developed countries (LLDCs) as designated by the United Nations.* These countries with a combined population of over 150 million include some of the poorest people in the third world. If the food production patterns of these countries are reasonably representative of the poorest group of people in the developing countries, then it is possible to use them as a proxy to determine whether the research programs of the international centres are oriented towards the needs of the poorest communities.

Table V provides a partial breakdown of the contribution of selected food crops to calorie and protein supplies in developing countries. As the contribution to LDC diets of non-IARC livestock and crops are not included, the data on protein and calorie intake are somewhat distorted to maintain comparability with IARC expenditure. The research programs of the international centres now cover crops and livestock which account for about 80% of the food supply of developing countries.

The Main Crop and Livestock Categories

Table I indicates that the relative IARC expenditure on cereals is declining (from 52% in 1974 to 43% in 1979) most rapidly of the four main research categories. The only category which will substantially increase its share of overall IARC research expenditure in this period is livestock which is expected to increase from 7% in 1974 to 24% in 1979. However, Table V indicates that in terms of their respective relative contribution to the diets of LDC and LLDC populations, livestock already receives considerably more funding relative to dietary importance than does cereal research. The difference is so great that the development of a substantial

*The twenty-five LLDCs (least developed countries) are those identified by the Committee for Development Planning during the 51st Session of the Economic Social Council of the United Nations in March-April, 1971.

cereals research program and only a minor livestock research program in the new ICARDA centre is unlikely to eliminate or greatly reduce the substantial overfunding of livestock relative to cereal research expenditure.

It is interesting to note in Table I that the specific allocation of funds to farming systems research, economics and nutrition is projected to decline from 16% in 1974 to 11% in 1979 despite an increased interest in farming systems research. It may be that an increasing proportion of the cost of these activities has been subsumed within the specific crop programs of the centres.

Individual Crop Funding

Tables III and IV provide a breakdown of centre expenditure within each of the three main crop categories and the significance of each of these crops to developing countries in general and specifically to the twenty-five least developed countries (LLDCs).

Cereals

Table IIIa indicates that sorghum and millet are considerably underfunded at present in terms of area cultivated and, more surprisingly, in terms of total LDC production. Sorghum and millet production is almost twice as large as their relative share of IARC expenditure. As sorghum and millet are major crops in the semi-arid regions of the world, which are among the poorest areas of the third world, it is not surprising that the distortion shown in Table IVa for just the LLDCs is even greater. Production of these two crops in the LLDCs is almost five times as great as their relative share of IARC expenditure. Furthermore, Table I indicates that the relative proportion of funds spent on sorghum and millet research is not expected to increase over the next four years.

Wheat and maize research is slightly overfunded in terms of both production and area cultivated in the LDCs, although CIMMYT's expenditure on barley and triticale was included in determining centre research on wheat. Expenditure on wheat and barley will increase substantially when the new

ICARDA centre becomes operational.

The data in Table IVa, which indicates that rice research is overfunded, is misleading as the LLDCs generally include few rice growing areas. Nevertheless, rice is an important food deficit crop and the rice growing areas of the world contain large numbers of poor people.

Root and Tuber Crops

Tables IIIb and IVb reveal major discrepancies between the relative levels of production and area cultivated and centre expenditure on the different root and tuber crops. Potato research received about three times as much funding relative to both area cultivated and production of potatoes in the LDCs (Table IIIb). The difference is even larger in Table IVb as the production of potatoes is minimal at present in the poorest countries. Centre expenditure on potato research is eight times as large as the level of production in the LLDCs.

Cassava research, on the other hand, is considerably underfunded in terms of LDC production and area cultivated and significantly more so in the LLDCs. Centre projections of expenditure up to 1979 indicate that their relative shares of expenditures on root and tuber research will change only slightly in favour of cassava.

Legumes

Tables IIIc and IVc indicate that IARC research expenditure on chick-peas is smaller than the expenditure on either cowpea or pigeon pea research. However, the production and area cultivated of chick-peas is greater than either the combined production or the area cultivated of the other two pea varieties in both the LDC and LLDC categories.

Field beans research, which is expected to receive a slightly greater share of centre expenditure in the future, is overfunded relative to production in the LDCs although not in the LLDCs. Groundnuts are underfunded in the LDCs and considerably so in the LLDCs. However, this discrepancy will be gradually reduced as ICRISAT develops its groundnut

research program.

Conclusion

The tables illustrate very significant discrepancies between the level of centre expenditures on the four major livestock and crop categories and their significance whether measured in terms of area cultivated, total production or contribution to the calorie and protein requirements of the LDCs. By the same criteria, there are also significant discrepancies between crops within each of the main crop categories.

The research program of the centres also appear to be oriented towards the food crops of the more prosperous developing countries if the twenty-five least developed countries are an adequate proxy for the poorest communities in the world.

By the same criteria, the centres are allocating a disproportionate share of research funds to those crops which are already most intensively studied outside the centres, whether in the developed or the developing countries. Centre research programs are relatively underfunded on those crops of most importance to the least developed countries, which usually have the most inadequately financed national research programs.

Projections of centre expenditures to 1979 indicate that in general these discrepancies will remain or, in some cases, even be accentuated in the next four years.

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Table I. Percentage of International Agricultural Research Centres (IARC) research expenditures devoted to various crops, 1974-1976.

Research Activity	(nine centers) 1976 Amount ($3,000,000)	1976 % of total research	(seven centers)[1] 1974 %	1975 %	1976 %
Cereals					
Wheat	2.3	10	12	12	12
Maize	2.2	10	11	11	11
Sorghum & Millet	0.7	3	4	3	5
Rice	4.3	19	22	22	22
"Cereal Improvement"	0.7	3	3	3	3
Sub-total	10.2	45	52	51	53
Roots & Tubers					
Cassava	0.7	3	3	3	4
Potatoes	1.0	4	5	6	6
"Root & Tuber Improvement"	0.6	3	4	3	3
Sub-total	2.3	10	12	12	13
Grain Legumes	2.6	11	13	12	10
Livestock	4.6	20	7	7	9
Other					
Farming Systems	2.7	12	14	16	14
Economic/Statistics	0.2	1	1	1	1
Nutrition	0.1	1	1	1	-
Sub-total	3.0	14	16	18	15
TOTAL	22.7	100	100	100	100

[1] CIAT, CIMMYT, CIP, IITA, IRRI, ICRISAT, WARDA.

Source: Consultative Group on International Agricultural Research. Executive Secretariat Integrative Report. ICW/75 July 11, 1975, p.7.

Table Ia. Percentage of International Agricultural Research Centres (IARC) core research expenditures devoted to various crops, 1976 and 1979 (planned).[1]

	1976 IARC Expenditure (nine centres) %	1979 Expenditure ($1,000,000)	1979 %
CEREALS			
Wheat	10	2.94[2]	10
Maize	10	2.86[2]	10
Sorghum & Millet	3	.93	3
Rice	19	5.22[3,4]	17
Cereal Improvement	3	.75	3
Subtotal	45	12.70	43
ROOTS & TUBERS			
Cassava	3	1.25	4
Potato	4	1.29	4
Root & Tuber Improvement	3	.74	3
Subtotal	10	3.28	11
GRAIN LEGUMES			
Chick-Peas & Pigeon Peas	3	.90	3
Field Beans	3	1.21	4
Grain Legume Improvement	4	.89	3
Groundnuts	1	.60	2
Subtotal	11	3.60	12
LIVESTOCK			
Cattle	19	7.01	23
Swine	1	.32	1
Subtotal	20	7.33	24
OTHERS			
Farming Systems	12	2.91	10
Economics/Statistics	1	.18	1
Food Technology & Nutrition	1	.13	0
Subtotal	14	3.22	11
TOTAL	100	30.13	100

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[1] These projections are based upon the individual 1976 IARC Programs of Work and Budget projections.

[2] The CIMMYT portion of the wheat and maize figures was derived by assuming that in 1979 wheat and maize research will receive the same percentages of CIMMYT's core operating funds as they will in 1976.

[3] The CIAT portion of the rice figures was derived by assuming that in 1979 rice research will receive the same percentage of CIAT's core operating funds as it will in 1976.

[4] The WARDA portion of the rice figures was calculated by assuming that the projected average yearly cost increase for the WARDA rice program from 1976 to 1978 will remain the same in 1979.

Source: Derived from: Consultative Group on International Agricultural Research. Executive Secretariat Integrative Report. ICW/75. July 11, 1975.

Table II. LDC area and dry weight production, and 1976 IARC expenditures on cereals, roots and tubers, and grain legumes.

	Area Cultivated LDCs		Dry Weight Production LDCs[1]		1976 IARC Expenditure	
	(1000 HA)	%	(1000 MT)	%	($1,000,000)	%
CEREALS						
(5 IARC cereals)[2]	276,533	79.3	309,909	80.7	10.256	67.6
ROOTS & TUBERS						
(4 IARC roots & tubers)[3]	18,298	5.2	43,173	11.2	2.353	15.5
GRAIN LEGUMES						
(6 IARC grain legumes)[4]	53,997	15.5	30,838	8.1	2.555	16.9
TOTAL	348,828	100.0	383,920	100.0	15.164	100.0

[1] Dry weight production calculated as follows: cereal and legume dry weight production is 85% of total production; for cassava 30%; for other roots and tubers 20%.

[2] The five cereals are wheat, maize, rice, millet and sorghum.

[3] The four IARC roots and tubers are cassava, potatoes, sweet potatoes and yams.

[4] The six IARC grain legumes are chick-peas, pigeon peas, cowpeas, field beans, groundnuts and soybeans.

Source: Food and Agriculture Organization. Production Yearbook 1973. Rome: Food and Agriculture Organization, 1975.

Consultative Group on International Agricultural Research. Executive Secretariat Integrative Report, ICW/75. July 11, 1975, Annex IV.

Table IIIa. Area, production, and 1976 IARC expenditure on five cereal crops.

CEREALS		World	LDC	IARC Research expenditure on cereals %	Production of Selected Cereals in LDCs %	Area Cultiv of Selected Cereals in L %
WHEAT	Area[a]	222,268	60,750			
	Yield[b]	1,696	1,182	22.8	19.7	22.0
	Production[c]	377,017	71,786			
MAIZE	Area	110,924	53,738			
	Yield	2,810	1,295	25.1[1]	19.1	19.4
	Production	311,780	69,597			
RICE (Paddy)	Area	134,163	92,422			
	Yield	2,390	1,944	45.2[2]	49.3	33.4
	Production	320,714	179,667			
MILLET	Area	67,927	34,699	)		
	Yield	668	503	)	4.8)	12.6)
	Production	45,370	17,464	)	)	)
				) 6.9	) 12.0	) 25.2
SORGHUM	Area	42,631	34,924	)	)	)
	Yield	1,214	747	)	7.2)	12.6)
	Production	51,768	26,085	)		
TOTAL	Area	577,913	276,533	100.0	100.0	100.0
	Production	1,106,649	364,599			

[a] All area in 1000 HA.

[b] All yields in KG/HA.

[c] All production in 1000 MT.

[1] The 25.1% figure is composed of 21.8% representing the CIMMYT maize expenditure and 3.3% representing the maize component of the IITA Cereal Improvement Program. Since there are no specific figures for each segment of the IITA Cereal Improvement Program, the 3.3% figure was obtained by assuming that the IITA Cereal Improvement budget is divided equally between maize and rice.

[2] The 45.2% figure was composed of 41.9% representing the IRRI, WARDA and CIAT rice programs, with the remaining 3.3% accounting for the rice portion of the IITA Cereal Improvement budget.

Source: Food and Agriculture Organization. Production Yearbook 1973. Rome: Food and Agriculture Organization, 1975.

Derived from: Consultative Group on International Agricultural Research. Executive Secretariat Integrative Report. ICW/75. July 11, 1975.

Table IIIb. Area, productio. , and 1976 IARC expenditure on ; .' root and tuber crops.

ROOTS & TUBERS		World	LDC	IARC Research Expenditure on Roots & Tubers	Production of Selected Roots & Tubers in LDCS	Area Cultiva of Selected Roots & Tube in LDCs
				%	%	%
CASSAVA	Area[a]	11,123	10,993			
	Yield[b]	9,567	9,581	37.6[1]	64.6	60.0
	Production[c]	106,418	105,328			
POTATOES	Area	22,010	2,481	43.6	12.9	13.6
	Yield	14,356	8,494			
	Production	315,988	21,071			
SWEET POTATOES	Area	15,069	2,855			
	Yield	8,854	6,461	9.4[2]	11.3	15.6
	Production	133,366	18,447			
YAMS	Area	1,969	1,969			
	Yield	9,323	9,323	9.4[2]	11.2	10.8
	Production	18,357	18,357			
TOTAL	Area	50,171	18,298	100.0	100.0	100.0
	Production	514,129	163,203			

[a] All area in 1000 HA.

[b] All yields in KG/HA.

[c] All production in 1000 MT.

[1] Of the 37.6%, three-quarters of cassava research, or 28.2% of total IARC Root and Tuber Research expenditure, is made by CIAT, with the remaining 9.4% spent at IITA. This latter figure is an estimate only, derived by dividing the cost of IITA's Root and Tuber Improvement Program evenly between its three segments, cassava, sweet potato and yam research.

[2] These figures are estimates, calculated as outlined in footnote #1, each representing one-third of the total cost of IITA's Root and Tuber Improvement Program.

Source: Food and Agriculture Organization. Production Yearbook 1973. Rome: Food and Agriculture Organization, 1975.

Derived from: Consultative Group on International Agricultural Research. Executive Secretariat Integrative Report. ICW/75. July 11, 1975.

Table IIIc. Area, productio.. and 1976 IARC expenditure on s. grain legume crops.

GRAIN LEGUMES		World	LDC	IARC Research Expenditure on Grain Legumes %	Production of Selected Grain Legumes in LDCs %	Area Cultivated of Selected Grain Legumes in LDCs %
CHICK-PEAS	Area[a]	9,648	9,407			
	Yield[b]	648	649	12.9[1]	16.8	17.4
	Production[c]	6,253	6,106			
PIGEON PEAS	Area	2,582	2,582			
	Yield	731	731	19.3[1,2]	5.2	4.8
	Production	1,887	1,887			
COWPEAS	Area	4,389	4,331			
	Yield	220	214	19.3[2]	2.6	8.0
	Production	965	926			
FIELD BEANS	Area	22,735	16,898			
	Yield	493	460	30.3	21.4	31.3
	Production	11,218	7,765			
GROUNDNUTS	Area	18,766	15,608			
	Yield	924	810	11.7	34.8	28.9
	Production	17,334	12,635			
SOYBEANS	Area	44,180	5,171			
	Yield	1,423	1,346	6.5[2]	19.2	9.6
	Production	62,882	6,961			
TOTAL	Area	102,300	53,997	100.0	100.0	100.0
	Production	100,539	36,280			

[a] All area in 1000 HA.

[b] All yields in KG/HA.

[c] All production in 1000 MT.

[1] It has been assumed that expenditures in the ICRISAT chick-pea and pigeon pea program are divided evenly between the two crops.

[2] Calculated on the basis that 60% of the IITA Grain Legume Improvement Program's funds are allocated to cowpeas, with the remaining 40% divided evenly between pigeon peas and soybeans. The latter estimation necessarily involves some imprecision, since a portion of the research expenditure assumed here to be spent on pigeon peas and soybeans is actually devoted to other grain legume crops such as lima beans, winged beans, yam beans, and velvet beans, but the magnitude of this expenditure, although not specified in IITA documents, is believed to be comparatively small.

Source: Food and Agriculture Organization. Production Yearbook 1973. Rome: Food and Agriculture Organization, 1975.

Derived from: Consultative Group on International Agricultural Research. Executive Secretariat Integrative Report. ICW/75. July 11, 1975.

Table IVa. LLDC area, production, and 1976 IARC expenditure on five cereal crops.

CEREALS		LLDC[1]	IARC Research Expenditure on Cereals[2]	Production of Selected Cereals in LLDCs	Area Cultivated of Selected Cereals in LLDCs
			%	%	%
WHEAT	Area[a]	4,185			
	Yield[b]	873	22.8	19.5	15.4
	Production[c]	4,854			
MAIZE	Area	6,479			
	Yield	1,488	25.1	31.7	23.7
	Production	7,888			
RICE (Paddy)	Area	3,192			
	Yield	1,166	45.2	19.1	11.7
	Production	4,751			
MILLET	Area	6,473			
	Yield	1,217		12.8)	23.7)
	Production	3,200			
			6.9	29.7	49.2
SORGHUM	Area	6,963			
	Yield	494		16.9)	25.5)
	Production	4,222			
TOTAL	Area	27,292	100.0	100.0	100.0
	Production	24,915			

[a] All area in 1000 HA

[b] All yields in KG/HA.

[c] All production in 1000 MT.

[1] The 25 LLDCs (least developed countries) are those identified by the Committee for Development Planning during the Fifty-First Session of the Economic and Social Council of the United Nations in March-April 1971.

[2] See footnotes 1 and 2 of Table IVa for details on the calculation of these figures.

Source: Food and Agriculture Organization. Production Yearbook 1973. Rome: Food and Agriculture Organization, 1975.

Derived from: Consultative Group on International Agricultural Research. Executive Secretariat Integrative Report. ICW/75. July 11, 1975.

Table IVb. LLDC area, production, and 1976 IARC expenditure on four root and tuber crops.

ROOTS & TUBERS		LLDC[1]	IARC Research Expenditure on Roots & Tubers[2] %	Production of Selected Roots & Tubers in LLDCs %	Area Cultivat of Selected Roots & Tuber in LLDCs %
CASSAVA	Area[a]	1,797			
	Yield[b]	8,961	37.6	74.1	57.9
	Production[c]	16,103			
POTATOES	Area	177			
	Yield	6,119	43.6	5.0	5.6
	Production	1,083			
SWEET POTATOES	Area	1,008			
	Yield	3,737	9.4	17.3	32.5
	Production	3,767			
YAMS	Area	124			
	Yield	6,282	9.4	3.6	4.0
	Production	779			
TOTAL	Area	3,106	100.0	100.0	100.0
	Production	21,732			

[a]All area in 1000 HA

[b]All yields in KG/HA.

[c]All production in 1000 MT.

[1]See footnote 1 of Table Va for an explanation of LLDC.

[2] See footnotes 1 and 2 of Table IVb for details on the calculation of these figures.

Source: Food and Agriculture Organization. Production Yearbook 1973. Rome: Food and Agriculture Organization, 1975.

Derived from: Consultative Group on International Agricultural Research. Executive Secretariat Integrative Report. ICW/75. July 11, 1975.

Table IVc. LLDC area, production, and 1976 IARC expenditure on six grain legume crops.

GRAIN LEGUMES		LLDC[1]	IARC Research Expenditure on Grain Legumes	Production of Selected Grain Legumes in LLDCs	Area Cultivated of Selected Grain Legumes in LLDCs
			%	%	%
CHICK-PEAS	Area[a]	360			
	Yield[b]	930	12.9	11.6	7.7
	Production[c]	387			
PIGEON PEAS	Area	154			
	Yield	494	19.3	2.4	3.1
	Production	76			
COWPEAS	Area	373			
	Yield	311	19.3	3.8	7.5
	Production	116			
FIELD BEANS	Area	2,041			
	Yield	523	30.3	34.4	40.7
	Production	1,068			
GROUNDNUTS	Area	2,048			
	Yield	720	11.7	47.5	40.8
	Production	1,475			
SOYBEANS	Area	11			
	Yield	727	6.5	0.3	0.2
	Production	8			
TOTAL	Area	5,014	100.0	100.0	100.0
	Production	3,103			

[a] All area in 1000 HA.

[b] All yields in KG/HA.

[c] All production in 1000 MT.

[1] See footnote 1 of Table Va for an explanation of LLDC.

[2] See footnotes 1 and 2 of Table IVc for details on the calculation of these figures.

Source: Food and Agriculture Organization. Production Yearbook 1973. Rome: Food and Agriculture Organization, 1975.

Derived from: Consultative Group on International Agricultural Research. Executive Secretariat Integrative Report. ICW/75. July 11, 1975.

Table V. Contribution of individual IARC food crops and livestock meat relative to their total contribution to LDC dietary intake in comparison with IARC research expenditures on these crops.

	Percentage of daily calories for all LDCs	Percentage of daily protein for all LDCS	Percentage of daily calories for LLDCs[1]	Percentage of daily protein for LLDCs	Percentage of 1976 IARC research expenditures on these crops
Wheat	18.1	22.6	12.8	14.2	11.6
Maize	10.5	10.7	19.2	17.5	13.4
Rice	35.9	28.4	11.4	9.1	23.8
Millet & Sorghum	11.2	12.9	29.7	29.6	3.5
Roots & Tubers	10.0	4.7	15.6	6.0	11.6
Pulses & Nuts	7.6	17.4	7.7	15.8	12.8[2]
Livestock	6.7[3]	3.3[3]	3.6[3]	7.8[3]	23.3
TOTAL	100.0	100.0	100.0	100.0	100.0

[1] See footnote 1 of Table Va for an explanation of LLDC. Not included in these calculations are Botswana, Lesotho, Bhutan, Maldives, Nepal and Western Samoa, for which figures are not available. Their absence does not materially affect the percentages, since they constitute only a small segment of the population, area or production of the crops under consideration.

[2] Grain Legumes.

[3] Beef, veal, mutton, lamb and pig meat.

Source: Derived from: Food and Agriculture Organization. Agricultural Commodity Projections 1970-1980. Vol.II. Rome: Food and Agriculture Organization, 1971.

Consultative Group on International Agricultural Research. Executive Secretariat Integrative Report. ICW/75. July 11, 1975.