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Food and Agriculture in West Asia and North Africa: Projections to 2000

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I. INTRODUCTION

Economic planning for the future requires in the first instance projections on relevant indicators. These will provide estimates of demand, production, input and investment requirements as well as criteria on which to base allocation and policy decisions. Many institutions are undertaking such studies of projections to the approaching end of the millenium. The Food and Agriculture Organization of the United Nations (FAO) produced a first version of its projections to 2000 in FAO (1981). The base year for this study was 1975. Considering that significant changes had occurred in agriculture in the developing countries, a revision of this study was undertaken with 1983 as the base year. Such a recent base year and the consequent reduction of the projection horizon to 17 years is expected to improve the robustness of the forecasts. The report of the study was submitted to the 1987 FAO Conference in FAO (1987).

Here, we shall look at the results of the Agriculture: Toward 2000 (abbreviated from hereon as AT2000) revision for West Asia and North Africa (WANA) (2). AT2000 focused on 93 developing countries but also touched upon China, developed market economies and European centrally planned economies.

An important objective in this paper is to provide information on which the planning of research priorities in WANA can be based. The results are presented in the regional aggregate. Research scientists are aware of the wide diversity that exists in WANA in the physical and socio-economic environments. This awareness needs to be complemented by the stock of knowledge at hand to identify critical areas of research as well as the priorities among these research areas.

Presentation of results in regional aggregates will prevent a priority evaluation among countries. However, the underlying major agricultural systems of WANA can be identified from the regional aggregate. Research geared to provide relevant technological options for these major agricultural systems can also be identified.

The plan of discussion is as follows. In the next section the projections of demand for major agricultural commodities will be presented followed by a discussion of production, input and investment requirements. The problem of meeting the large food deficits in WANA will be the main theme of the concluding section.

II. DEMAND FOR AGRICULTURAL COMMODITIES IN WANA

When consumers are disaggregated into different income classes and rural-urban distinctions, one can get a fairly good understanding of the factors that influence demand. The following aggregate picture is then presented with the caveat that it hides such distinctions.

The growth of aggregate demand for a commodity is influenced by three factors:

$$g_d = g_P + eg_y$$

Here g is the growth rate and the subscripts denote demand (d), population (P) and income per capita (y). The income elasticity of demand is denoted by e. Hence, the growth of demand is equal to population growth plus income growth weighted by the income elasticity of demand. In general, the income elasticities for food are lower than those for other commodities and the income elasticities for staples are lower than those for other foods.

In WANA, population is projected to increase from 408 mill in 1983 to 627 mill in 2000 and GDP per capita (in 1980 US dollars) from $1175 to $1425. This implies annual growth rates of 2.6 percent and 1.1 percent respectively for population and per capita income.

The average daily per capita calorie consumption in WANA is 2550 Kcal which is considerably above the Basic Metabolic Rate

(BMR) minimum (Table 1). However, there is a wide range observed among countries in WANA from under 1650 Kcal in Ethiopia to over 3500 Kcal in Libya as well as within countries. These averages should under no circumstances be interpreted as absence of undernutrition or malnutrition.

TABLE 1 Structure of total demand for major agricultural products in WANA (mill.MT)

Agricultural Commodities	Food Demand		Feed Demand		Total Demand		Deficits (-)		SSR (%)	
	1930	2000	1983	2000	1983	2000	1983	2000	1983	2000
Wheat	53.3	80.5	4.4	9.6	69.1	105.4	-21.6	-33.9	69	68
Rice	11.0	17.2	-	-	11.0	18.4	-1.2	-2.9	90	84
Maize	6.2	9.6	5.7	13.4	18.2	25.2	-4.8	-11.2	71	70
Barley	3.4	5.3	11.5	27.6	19.3	37.4	-5.5	-11.2	71	70
Coarse grains	15.3	24.7	18.6	43.8	40.2	76.3	-10.3	-22.9	73	70
Cereals	75.4	116.6	23.1	53.4	116.6	193.9	-32.6	-58.9	71	70
Sugar	11.4	20.7	0.2	0.4	12.1	21.9	-4.3	-7.8	68	64
Pulses	3.1	4.6	0.4	0.4	4.1	5.7	0.2	0.2	107	103
Vegetable oils	4.0	7.5	0.1	0.1	4.7	8.9	-2.5	-5.7	44	36
Cotton (lint)	-	-	-	-	1.5	2.3	0.7	0.7	146	130
Beef	2.6	4.4	-	-	2.6	4.4	-0.6	-0.9	77	80
Mutton	2.3	3.9	-	-	2.3	3.9	-0.3	-0.3	89	91
Poultry	2.0	4.5	-	-	2.0	4.5	-0.5	-0.3	77	94
Milk	28.0	47.2	3.9	6.6	35.5	59.8	-6.5	-11.4	82	81
Meat	6.9	12.9	-	-	6.9	12.9	-1.3	-1.5	81	88
Kcalories/ capita/day	2550	2715	503	736	3526	3893	-958	-1172	73	70

Source: AT2000 files and FAO Supply Utilization Accounts files.

The average per capita income in WANA is higher than that of the 93 LDC in AT2000. This contrast of $1175 vs $780 is projected to be narrowed in 2000 to $1425 vs $1086. The higher level of income influences some aspects of food consumption. For example, the higher income elasticity livestock products are consumed at a higher per capita level than in the 93 LDC as a whole: meat at 17 kg vs 12 kg; milk at 69 kg vs 44 kg. The basic staple wheat is consumed at more than two and a half times the average in the 93 LDC; 131 kg vs 51 kg. Pulses are an important source of protein for the poorer segments of the population but on the average consumed at a lower rate than that in the 93 LDC: 7.6 kg vs 9.2 kg.

One salient characteristic of high income levels is the switch from direct to indirect consumption of cereals. As incomes increase the higher income elasticity of demand for the indirect consumption of cereals becomes the driving element of the demand for cereals while the direct demand stabilizes or decreases. This indirect demand for cereals is the derived demand for the use of cereals as feed for livestock.

This development is observed clearly in WANA (Tables 1 and 2) where the per capita indirect use of cereals for feed is 57 kg vs 31 kg for the 93 LDC. The direct food demand for cereals is driven entirely by population growth. On the other hand feed demand grows at virtually double the population growth rate because of the demand generated by high incomes and higher income

TABLE 2 Projected demand growth rates and implicit income elasticities for major agricultural commodities in WANA (1983-2000)

Agricultural Commodities	Annual Growth Rates (%)			Implicit Income Elasticities		
	Food Demand	Feed Demand	Total Demand	Food Demand	Feed Demand	Total Demand
Wheat	2.5	4.6	2.5	-0.10	1.82	-0.04
Rice	3.1	-	3.1	0.50	-	0.45
Maize	2.5	5.1	3.8	-0.04	2.25	1.12
Barley	2.6	5.3	4.0	0.06	2.35	1.24
Coarse grains	2.8	5.2	3.8	0.25	2.27	1.12
Cereals	2.6	5.1	3.0	0.03	2.19	0.41
Sugar	3.6	4.1	3.5	0.88	1.32	0.85
Pulses	2.4	-0.4	2.0	-0.17	-2.60	-0.49
Vegetable oils	3.7	4.1	3.9	1.02	1.32	1.16
Cotton (lint)	-	-	2.3	-	-	-0.24
Beef	3.1	-	3.1	0.43	-	0.43
Mutton	3.2	-	3.2	0.56	-	0.56
Poultry	5.0	-	5.0	2.16	-	2.16
Milk	3.1	3.1	3.1	0.49	0.48	0.49
Meat	3.7	-	3.7	1.01	-	1.01
Kcalories/cap/day	0.4	2.3	0.6	-1.93	-0.27	-1.74

Note: The projected population growth rate is 2.57 percent per year and the projected annual growth rate of per capita income is 1.14 percent.

Source: AT2000 files based on FAO Supply Utilization Accounts files.

elasticities. Of course, this is more so for coarse grains and particularly for barley. Three quarters of the barley grown or consumed in the 93 LDC is in WANA. It is characteristically utilized in the integrated barley-livestock systems observed in the drier areas of WANA where small ruminants (sheep and goats) form the livestock component.

Three commodities are also projected to have growth rates higher than population: sugar, vegetable oils and livestock products. All three have high implicit income elasticities. Poultry meat in particular is expected to face high growth in demand. As poultry production is highly dependent on coarse grains used as feed, it will generate substantial demand, particularly for maize. Mutton, which is preferred more in WANA than the 93 LDC as a whole, will maintain its share in the demand for red meat. Most of the milk demand is for cow milk but ewe's milk is an important source of high quality animal protein in rural areas where it is consumed in preserved dairy products such as yogurt and cheese (Somel and Mokbel, 1986).

Certain pulses, such as lentils, chickpeas and faba beans are important as protein sources in diets in WANA, particularly in urban areas and among the poor. However, on average, the per capita consumption of pulses is projected to decrease as livestock products become the preferred source of protein with higher incomes.

TABLE 3 Land resources in WANA (mill ha)

	Low Rainfall	Uncertain Rainfall	Good Rainfall	Problem Lands	Naturally Flooded	Desert	Irrigated Areas	Total
1983								
Rainfall use	38.5	15.0	22.8	17.0	12.7	-	-	106.0
Irrigated use	6.6	2.2	1.5	1.0	4.7	19.4	35.4	35.4
Total use	45.1	17.2	24.3	18.0	17.4	19.4	35.4	141.4
Reserves	9.4	9.8	7.7	29.2	4.7	13.4	65.6	
Use/total potential (%)	83	64	76	38	79	81	73	68
Harvested area (a)	16.4	9.7	16.8	11.7	6.8	-	3638	98.2
Cropping intensity (%) (a)	42	65	74	69	54	-	104	69
2000								
Rainfed use	38.0	15.3	22.6	18.0	12.7	-	-	106.6
Irrigated use	7.3	2.8	2.1	1.1	4.8	22.2	40.3	40.3
Total use	45.3	18.1	24.7	19.1	17.5	22.2	40.3	146.9
Reserves	9.3	8.9	7.4	28.0	4.7	1.8	8.5	60.0
Use/total potential (%)	83	67	77	41	79	93	83	71
Harvested area (a)	17.0	11.6	19.3	12.7	7.0	-	45.9	113.4
Cropping intensity (%) (a)	45	76	85	70	55	-	114	77

Notes: a. Refers to rainfed agriculture in non-irrigated areas.

Source: AT2000 files: the land classification is based on FAO agro-ecological zoning which reflects both soil quality and length of growing period, FAO (1987), p 126, cf Table 6 below.

TABLE 4 Crop production in WANA (a)

	1967/63			1981/85			2000			Production Growth Rate (%)			Area Growth Rate (%)			Yield Growth Rate (%)		
	Prod.	Area	Yield	Prod.	Area	Yield	Prod.	Area	Yield	61-85	75-85	81/85-2000	61-85	75-85	81/85-2000	61-85	75-85	81/85-2000
Wheat	25.1	27.6	0.9	47.9	33.1	1.5	71.5	33.6	2.1	3.3	1.6	2.4	0.8	-0.1	0.1	2.5	1.7	2.3
Rice	5.0	2.2	2.3	9.6	3.1	3.1	15.4	3.9	4.0	3.0	0.7	2.8	1.6	0.3	1.2	1.4	0.4	1.6
Maize	5.1	3.7	1.4	8.5	4.0	2.1	14.2	4.9	2.9	2.5	2.0	3.0	0.5	0.7	1.1	2.0	1.4	1.9
Barley	9.7	10.7	0.9	14.3	12.7	1.1	26.1	15.5	1.7	2.1	2.9	3.6	0.8	2.3	1.2	1.2	0.5	2.4
Coarse grains	22.7	23.9	1.0	30.9	285	1.1	53.3	32.3	1.7	1.6	1.3	3.3	0.7	1.5	1.0	0.9	-0.1	2.3
Cereals	52.8	53.7	1.0	88.4	63.8	1.4	140.2	69.8	2.0	2.6	1.4	2.8	0.8	0.6	0.5	1.8	0.8	2.2
Sugarbeet	4.3	0.2	21.6	19.3	0.6	30.5	35.6	0.9	37.6	6.8	2.7	3.7	5.2	2.5	2.4	1.5	0.2	1.2
Sugarcane	20.6	0.5	39.6	50.2	1.1	45.1	87.4	1.6	54.5	4.0	4.1	3.3	3.6	3.5	2.2	0.5	0.6	1.1
Pulses	3.2	4.5	0.7	4.3	5.3	0.8	5.9	6.0	1.0	1.3	2.1	1.9	0.8	1.8	0.8	0.5	0.3	1.1
Oil crops (b)	2.0	1.2	1.6	2.7	3.0	0.9	4.1	5.2	0.8	1.7	-0.4	2.5	4.7	0.6	3.3	-2.8	-1.0	-0.8
Soybeans	0(c)	0	0.9	0.3	0.1	2.2	1.0	0.4	2.5	18.0	13.3	6.8	13.1	8.5	6.1	4.4	4.4	0.7
Sunflowers	0.1	0.1	0.8	0.8	0.6	1.2	1.3	1.1	1.2	9.6	4.4	3.5	7.9	3.3	3.4	1.6	1.1	0.1
Groundnuts	0.4	0.4	1.2	0.7	0.9	0.8	1.5	1.3	1.1	3.3	-6.6	4.3	4.9	-3.2	2.1	-1.5	-3.4	2.1
Sesame	0.3	0.7	0.5	0.4	1.2	0.3	0.4	1.1	0.4	0.4	-2.6	0.8	2.6	-0.6	-0.2	-2.2	-2.0	1.0
Seed cotton	4.3	4.0	1.1	6.6	4.3	1.5	8.5	5.0	1.7	1.7	2.9	1.5	0.2	0.5	0.9	1.5	2.3	0.7

Notes: a. Production in mill T, Area in mill ha, Yields in MT/ha.
b. This is oil crops other than the four stated beneath and for WANA, it is essentially olive oil.
c. 0 means less than 0.05 mill MT, or less than 0.05 mill ha.

Source: AT2000 files.

In general, food demand in WANA is projected to be characterized by the maintenance of the direct per capita consumption rates of staples but high rates of indirect consumption of cereals for feed and high rates of consumption of livestock products.

III. AGRICULTURAL PRODUCTION IN WANA

In WANA, agricultural production is constrained by land and water resources. Only a quarter of the land is under irrigation (Table 3) and in rainfed areas rainfall exhibits substantial variation between years as well as between areas. Currently, over nine tenths of land reserves are in Sudan (75 percent) and Ethiopia (16 percent) and the quality of these land reserves is relatively inferior. In the rest of WANA, the limits of agricultural land have been reached. Therefore, increases in production can come about essentially through yield and cropping intensity increases. In fact, these two sources will account respectively for 72 and 21 percent of total crop production increases in WANA. This implies both higher use of improved technologies and more intensive use of land, particularly reduced fallow. Furthermore, irrigated areas have to increase by 14 percent so as to allow a 25 percent increase in harvested irrigated areas.

Cereals (Table 4) cover the largest area in WANA. Between the two main cereals, wheat is projected to shift out of drier

areas and to be replaced by barley which has a biological advantage in terms of adaptation to dry areas (Table 6). The shift to wetter areas and use of improved technologies will allow wheat to maintain long term yield growth trends and improve over more recent production trends. The area increase in barley will contribute to production increases but the major source of change will be yield growth brought about by the diffusion of improved technologies. Currently, wheat commands the largest share in fertilizer use with 29 percent but barley gets only 8 percent. By 2000, wheat will increase its share to 31 percent but barley will become the second major user of fertilizer with 13 percent. In per hectare terms this means that wheat will increase fertilizer use from 51 to 140 kg/ha and barley will increase from 35 to 122 kg/ha. Due to its importance mainly as poultry feed but also to some extent as cattle feed, maize will also gain importance in production. The same can be said for rice which is becoming the status cereal is WANA.

The growing demand for sugar will be partly met by production increases stemming from modest yield increases in sugarbeet and sugarcane. In pulses, modest yield increases are projected as well. In vegetable oil crops, the relative importance of olive oil will decline as other sources (soybeans, sunflowers, maize, groundnuts, sesame and cotton seed) increase their share in production. However, olive oil should still remain as a most important source of vegetable oil.

TABLE 5 Livestock production in WANA

	Meat Production (mill MT)			Number of Animals (mill)			Off-Take Rate (%)			Carcass Weight (kg/an)			Meat Production Growth Rate (%)			Livestock Nos. Growth Rate (%)		
	61-63	83-85	2000	61-63	83-85	2000	61-63	83-85	2000	61-63	83-85	2000	61-85	80-85	2000	61-85	80-85	2000
Cattle and buffaloes	1.2	2.1	3.5	88.2	120.9	150.0	12.8	15.6	18.4	107	109	126	2.4	3.6	3.3	1.4	1.3	1.4
Sheep and goats	1.2	2.0	3.6	251.3	355.3	490.2	35.5	40.8	43.6	13	14	17	2.6	2.9	3.7	1.6	0.4	2.0
Poultry	0.3	1.7	4.3	198.5	662.9	1130.0	169	240	287	1.0	1.1	1.3	7.8	10.0	6.0	5.3	9.8	3.4

	Meat Production (mill MT)			Number of Animals (mill)			Milk Productivity (kg/ha)			Milk Production Growth Rate (%)			Livestock Nos. Growth Rate (%)		
	61-63	83-85	2000	61-63	83-85	2000	61-63	83-85	2000	61-63	83-85	2000	61-85	80-85	2000
Cow and buffalo milk	13.3	23.3	39.0	18.0	28.6	38.7	742	814	1008	2.6	2.6	3.3	2.1	1.5	1.9
Sheep and goat milk	4.1	6.3	9.2	71.9	110.5	140.4	57	57	65	2.2	0.4	2.3	2.2	0.6	1.5

Source: AT2000 files.

TABLE 6 Agro-ecological distribution of wheat, barley and pulses production in WANA

	Low Rainfall			Uncertain Rainfall			Good Rainfall			Problem Areas		
	Area	Yield	Prod.	Area	Yield	Prod.	Area	Yield	Prod.	Area	Yield	Prod.
1983												
Wheat	2458	0.6	1378	2775	1.1	2928	6715	1.5	10129	5321	1.6	8398
Barley	4251	0.6	2735	2442	1.3	3196	1552	1.7	2590	2311	1.1	2593
Pulses	1199	0.3	402	599	0.7	446	1481	1.0	1548	579	0.8	475
2000												
Wheat	1838	0.7	1294	3056	1.8	5529	6048	2.1	12614	4627	2.2	10135
Barley	4338	0.9	3815	2951	1.9	5752	2066	2.6	5287	3132	1.8	5525
Pulses	1300	0.4	538	711	0.9	639	1769	1.2	2203	604	0.9	533

	Naturally Flooded			Total Irrigated			Total		
	Area	Yield	Prod.	Area	Yield	Prod.	Area	Yield	Prod.
1983									
Wheat	5200	0.9	4655	10913	1.8	19995	33382	1.4	47483
Barley	675	0.9	609	1470	1.3	1858	12701	1.1	13581
Pulses	105	0.6	60	1370	1.0	1422	5332	0.8	4352
2000									
Wheat	4734	1.3	6265	13260	2.7	35654	33565	2.1	71491
Barley	1129	1.1	1280	1854	2.4	4485	15469	1.7	26145
Pulses	202	0.7	144	1414	1.3	1840	5999	1.0	5897

TABLE 6 Continued.

Notes:

1. Area in thousand ha, yields in MT/ha, production in thousand MT

2. 1983 is average of 1982-84, hence there are differences with Table 4.

3. The land classes in AT2000 are defined (FAO, 1987, p 126) using suitability classes from the FAO Agro-Ecological Zone study. The four suitability classes - very suitable, suitable, marginally suitable and not suitable - are related to the anticipated yield as a percentage of the maximum attainable under optimum agro-climatic and soil conditions.

   The definition of the six land-water classes is as follows:

   Low rainfall rainfed land: Rainfall providing 1-119 growing days, soil quality very suitable, suitable or marginally suitable.

   Uncertain rainfall rainfed land: Rainfall providing 120-179 growing days, soil quality very suitable or suitable.

   Good rainfall rainfed land: Rainfall providing 180-269 growing days, soil quality very suitable or suitable.

   Problem lands: The term is used to designate areas with excessive moisture and/or unsuitable soils. In these areas rainfall provides more than 269 growing days, soil quality is very suitable, suitable, or marginally suitable. Also included in this class is that part of the 120-269 growing days zones where soil rating is only marginally suitable.

   Naturally flooded land: Land under water for part of the year and lowland non-irrigated paddy-fields (gleysols).

   Irrigated lands: These comprise both fully irrigated lands which are equipped for irrigation and suitable drainage and not suffering from water shortages and of partially irrigated lands which are equipped for irrigation but lacking drainage or reliable water supplies or with low quality and reliability of distribution.

   Another land class is desert lands which are not suitable for agriculture except under irrigation. The four rainfed land classes are alternatively called arid and semi-arid, dry sub-humid, moist sub-humid and humid in the order above.

In livestock production (Table 5) , increases in productivity will also be important. For example, in meat production, 44 percent of the growth will be due to increases in carcass weight with the rest equally divided between herd increases and increases in the off-take rate. The shift to intensive livestock production, gradual as it may be, will allow less inputs to go for maintenance and more for productivity.

It is also hoped that intensification will reduce the dependence on the fragile grazing resources in the steppes and the marginal lands and halt or even reverse the environmental degradation process arising from exploitative stocking rates. Productivity increases and intensification both imply increased importance for the input of veterinary services and management.

The requirements of such intensive crop and livestock technologies imply high growth rates in input use (Table 7). The use of chemical and mineral inputs as well as improved seeds will increase substantially.

Agriculture in WANA is highly mechanized. While labour use as well as the labour utilization rate is projected to increase, the historical growth in tractors will continue to be important. Tractor use will increase in intensity as arable land per tractor decreases and tractors work more per unit area with higher intensity of cropping.

TABLE 7 Input requirements in WANA

	1983	2000	1983-2000 Growth-Rate (%)
Total fertilizer (mill MT)	5.9	14.9	5.6
N	3.8	9.5	5.6
P_2O_5	1.9	4.9	5.7
K_2O	0.2	0.5	6.5
Fertilizer/ha of harvested land (kg)	59.9	131.6	4.7
N	38.5	83.7	4.7
P_2O_5	19.5	43.2	4.8
K_2O	1.9	4.8	5.6
Plant protection (1980 $mill)	1166	1686	2.2
Cereal feed (mill MT)	23.1	53.4	5.1
Agricultural labour (mill man days)	7802	11306	2.2
Labour utilization rate (mandays/year)	117	141	1.1
Tractors (thousands)	1035	1608	2.6
Arable land (ha)/tractor	137	91	-2.3
Traditional cereal seed (mill MT)	3.8	2.5	-2.3
Improved cereal seed (mill MT)	2.3	4.3	3.8

Source: AT2000 files.

The production increases in WANA and its input requirements have serious implications for agricultural investment (Table 8). Investment in primary agriculture will total nearly $180 bill between 1983-2000. Irrigation and mechanization alone will account for three quarters of crop investment. Investment in livestock production, comprising of herd increases and meat and milk storage, production and processing facilities, is projected to entail over $60 bill.

The investment definitions in AT2000 are quite comprehensive but may cover certain allocations that should not be charged all to agriculture. Multiple purpose hydro-electric dams, tractors used for transportation, etc. are examples. Some investments, particularly those at the farm level, may not involve actual cash outlays but such activities would have positive opportunity costs. Even with these caveat, it cannot be denied that investment requirements by 2000 pose serious challenges. The high incremental capital-output ratio (ICOR) of 7.6 dispels the myth that agriculture is not a capital-intensive sector. It also implies that probably unprecedented agricultural investment rates of over 20 percent of agricultural GDP will have to be maintained. As some investments will be quite bulky, this burden will increase substantially in certain periods.

The question whether these challenges are surmountable depends on the commitment to implement changes on many fronts.

TABLE 8 Agricultural investment requirements in WANA 1983-2000 (1980 $ bill)

	Net	Gross
Land development (a)	0.6	10.8
Irrigation	57.1	78.2
Permanent crops	5.5	7.7
Tractors and equipment	29.0	35.9
Working capital	0	7.4
CROP INVESTMENT	102.1	150.7
LIVESTOCK INVESTMENT	1.1	27.1
INVESTMENT IN PRIMARY AGRICULTURE	103.3	177.7
SUPPORT INVESTMENT (b)	34.4	120.3
TOTAL AGRICULTURAL INVESTMENT	137.7	298.0
Incremental capital/output ratios (ICOR) (c) (ratio)		7.6
Agricultural investment rate (d) (%)		21.7

Notes: (a) Includes development of arable land, soil and water conservation and flood control. Net pertains only to flood control.

(b) Includes investment in processing, transport and marketing.

(c) Gross primary investment/increase in GDP.

(d) Annual average of gross primary investment as % of agricultural GDP.

Source: AT2000 files.

IV. POLICY IMPLICATIONS

The policy implications relate to agricultural research and the development of agricultural productive capacity.

Research priorities would necessarily have to be linked to the pivotal areas of projections. These can be summarized under four major areas:

a. Wheat

b. Feedstuffs

c. Livestock production

d. Irrigation and water management

These will be elaborated upon in reverse order.

Before this however, two commodities will be touched upon. These are sugar and vegetable oils. It is conjectural if the region has much comparative advantage in sugar production. While investments in sugarbeet production and sugar production are politically popular, in most areas the sugarbeet land may have better uses which may generate more funds than necessary to import sugar from the international market. In vegetable oils, the sources are diverse and ecological adaptability has to be explored in the expansion of oil crops. These should be attractive crops due to the high demand for cooking oil but also because of the feed value of by-products.

In very few places in the world are land constraints as binding as in WANA. It is also a fact that major parts of the

region are under rainfed agriculture while the major part of agricultural production is in irrigated areas.

The projected production increases are dependent upon using the scarce water resources (whether from irrigation or rainfall) more efficiently and in combination with other inputs such as fertilizer in order to raise both yields and cropping intensity. Hence, increasing water use efficiency should be a primary focus of research. Ways of using land more intensively need to be explored. In particular, replacing fallows with food and forage legumes in rotation with cereals appears to have potential.

Livestock production in WANA currently is carried out under a quite extensive mode. Production in the drier areas depends on grazing, usually over large areas which are viewed as a free good from the "commons", i.e., communal grazing areas. Can the livestock production increases projected for WANA be achieved without radical changes in production technology and management?

It appears that current research efforts predominantly are within the technological frame of the existing extensive livestock production systems. The point has already been made that these extensive systems cannot be perpetuated without drastic protective measures against the adverse effects they will have on the environment. It would imply that research for the 21st century's needs would have to look at the alternative of intensifying livestock production. Intensification here is used to mean less dependence on extensive grazing on the "commons" and more

dependence on feedstuff production in viable areas of production. Admittedly, intensification is a relative matter of degree but complete feedlot sheep production is neither implied nor envisaged in the nature of things in the foreseeable future in WANA. Even with this qualification, it would seem that the research problems of a higher degree of intensification of livestock production are somewhat different from those of the current extensive systems. The change of focus would have implications for management research, changes in the quality and quantity of veterinary service inputs and in the crops involved.

There is also the need for policies not to increase and preferably to reduce the pressure of livestock production on marginal areas and the steppes with tenuous environmental balances. It is possible that increased feed availability may result in increasing herd sizes rather than increasing intensification. Increased herd sizes with the same practices as currently practiced would cause ravaging environmental damage in the marginal areas and the steppes which would now be grazed by larger numbers of livestock. Therefore, the increased feed available should be primarily a substitute for such grazing areas in order to arrest environmental damage. This is one aspect of intensification of livestock production that is implied.

The crops that are used as feedstuffs, particularly for sheep production in the dry areas, are few with barley having an overwhelming dominance. The response of the current systems to

increased feed demand has been to produce more barley by continuous cropping or expanding into marginal areas both with serious effects on soils. Research should be able to increase the crop mix primarily by introducing new options in forage legumes as feed crops and as elements in crop rotations. These forage legumes would also have beneficial effects on soils through biological nitrogen fixation.

Finally, wheat, which is in a class by itself, should be supported both by maintenance research and by efforts to advance the production frontier. In some places, wheat is grown in rotation with food legumes, mainly lentils and chickpeas. Again, these food legumes would enhance biological nitrogen fixation.

Research on forage and food legumes can hence be also justified from the perspective of long term viability and sustainability of agricultural production.

Despite the need for massive undertakings and accelerated change, the agricultural sector will not be able to meet the demand in WANA as is also the case currently. Deficits are projected to continue in all commodities except pulses and cotton. In pulses, the surplus is illusory because a considerable portion of pulses in WANA is produced in surplus in Turkey and most countries are in deficit status.

In many commodities, even when self-sufficiency ratios remain stable or improve, the absolute magnitude of the deficits

will increase. Major deficits are forecast for wheat, coarse grains, sugar, vegetable oils and livestock products (Table 1).

Food self-sufficiency is stated as a policy objective in many countries in WANA. With a few exceptions, this will be a difficult and possibly infeasible task within this century. Hence, the dependence on food imports will continue. However, this can be a matter of degree and the question remains on the opportunity costs of meeting demand through domestic production as opposed to imports, mainly from outside the region. Currently, agricultural prices are depressed in international markets due on the one hand to the surpluses created in developed market economies, particularly in the FEC and north America through extensive subsidy schemes, and on the other hand due to the limits imposed on LDC exports by protectionist measures and market satiation. The production subsidies in the developed countries have distorted international prices to such low levels that the lowest cost producers of some commodities, e.g., dairy products in New Zealand, may be driven out of the market and become importers. The general tendency in the developing countries under these conditions of depressed prices is to import, provided there are resources which can generate the funds for imports.

However, the long term prospects would counsel caution. First, there are increasing pressures within the developed countries to reduce subsidies and surpluses. Second, many studies provide clear illustration of positive global economic and welfare

effects as a consequence of the reduction of such protective measures in the developed countries. Finally, while imports in LDC may provide relief in the short run, these are competitive with domestic production in many instances and may influence the development of agricultural productive capacity adversely. Invariably this is overlooked due to the priority given to the provision of cheap food to urban consumers, not without due regard to the political pressures that these concentrated urban populations can generate.

If prices are depressed because of distortions in the market which should not be expected to last, it may be desirable to invest in domestic agriculture for the long run. For WANA, even with the projected large deficits, substantial investment in agriculture will be necessary in any case. In addition, measures have to be taken in WANA against the exploitative methods of agriculture that have serious consequences in environmental degradation. The current price and policy environment does not appear to provide adequate incentives to reduce environmental degradation.

WANA faces important challenges in reorganizing a dynamic agricultural sector, beset by uncertainties stemming from both climatic and price sources, to one that will meet the demands of growing economies. Solutions will come from a commitment for improving both the technological structure as well as the economic conditions in the agricultural sector.

NOTES

(1) Economist, Farm Resource Management Program. This paper is based on the Agriculture: Toward 2000 study undertaken by the Global Perspectives group at the Food and Agriculture Organization of the United Nations. The project was headed by Dr. Nikos Alexandratos and the simulation modeling coordinated by Dr. Jelle Bruinsma but many contributed to the study. The author was seconded by ICARDA to participate in this study during his sabbatical leave in 1986/87. The views presented in this paper do not necessarily reflect the policies of ICARDA, FAO and their donors and belong solely to the author who is responsible for its contents including any errors that remain.

(2) The regional classification of WANA is not used in AT2000 but it covers the AT2000 region of Near East and North Africa plus some countries in East Africa and West Asia. These countries are: Afghanistan, Algeria, Cyprus, Egypt, Ethiopia, Iran, Iraq, Jordan, Lebanon, Libya, Morocco, Pakistan, Saudi Arabia, Sudan, Syria, Tunisia, Turkey, Yemen Arab Republic and Yemen People's Democratic Republic.

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