

PROJECTING IRANIAN AGRICULTURAL DEMAND AND SUPPLY

Allen D. LeBaron¹
(Invitational Paper)

INTRODUCTION

What are the prospects for Iranian agriculture? What are the likely magnitudes of future agricultural exports and imports? Answers to these questions have been proposed in a United States Department of Agriculture sponsored report directed to long-term projections of supply and demand (6). The report is one in a series of international studies that have appeared since the middle 1960's.

The Iranian projections are based on extensive review and interpretation of domestic and international statistics undertaken in January, 1967. Data were collected in Iran by a small group organized by Utah State University during the summer of 1967 and the Spring of 1968. Due to delays, another three years passed before data reduction and analysis, manuscript revision, and publication were completed,²

One object of the field work was to collect and review everything available that would shed light on the status and possibilities for Iranian agriculture. The conclusions are not influenced by official or unofficial views of the Imperial government of Iran or of the United States Department of Agriculture.

The report forecasts difficult times for the most important segments of Iranian agriculture, grains and livestock, for at least a decade.

FINDINGS

The projection results for 1975 and 1980 are summarized in Table 1.³ Naturally, the values shown in the table may or may not materialize in any particular year due to

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1. Professor, Department of Economics, College of Agriculture, Utah State University, Logan, Utah, U.S.A.
 2. Two other sets of agricultural supply and demand projections for Iran are available: FAO's Indicative World Plan, Near East (4), and an unpublished Ph.D. dissertation (7). The Utah State study is more comprehensive than either of these.
 3. Domestic demand for industrial crops such as cotton or kenaf is difficult to estimate, so most emphasis is on products especially linked to human consumption.

TABLE 1. Summary: supply-demand projections for selected Iranian agricultural products (1,000 metric tons).^a

	Demand		Supply			Indicated Demand/ Supply Balance	
	1975	1980	1965	1975	1980	1975	1980
Annual Crops							
Wheat	5,812.0	6,908.4	3,863.0	4,893.9	6,035.2	-	-
Barley	933.2	1,102.4	917.6	1,097.8	1,293.6	+	+
Rice (paddy)	1,476.8	1,798.8	944.6	1,528.8	2,040.1	+	+
Minor Grains	68.7 ^b	77.0 ^b	51.4	54.0	56.6	-	-
Sugarbeet equivalent	5,484.7	6,601.2	1,315.8	3,585.1	5,124.2	-	-
Oil seeds equivalent ^c	281.3	388.7	15.5	156.4	279.9	-	-
Cottonseed	528.3	708.6	275.6	528.3	708.6	0	0
Pulses	190.3	242.4	108.0	219.0	282.8	+	+
Melons	1,319.9	1,719.3	816.4	1,340.0	2,067.8	+	+
Potatoes	554.7	693.7	311.7	569.4	894.7	+	+
Green Vegetables (including onions)	2,308.3	2,894.1	1,346.3	2,351.7	2,779.1	+	- ^e
Spices and Seed	14.9	17.8	15.8	17.5	19.2	+	+
Perennial Crops							
All Nuts (unshelled)	84.6	108.2	55.0	101.0	132.3	+	+
Apple-Pear	186.7	242.4	106.7	180.3	273.9	-	+
Peach-Apricot	70.7	90.2	72.9	123.2	179.0	+	+
Dates	220.9	254.2	169.0	243.3	303.2	+	+
Grapes	473.0	594.5	433.0	572.0	672.5	+	+
Other Fruits	149.7	185.8	101.7	158.9	198.6	-	+
Citrus	318.6	408.3	160.0	295.0	438.8	-	+
Tea	45.6	55.2	17.0	32.0	47.0	-	-
Livestock (head)^d							
Sheep-Goat	16,835.2	19,196.9	10,500.0	13,869.0	15,924.0	-	-
Cow- Buffalo	1,417.8	1,655.3	870.0	1,031.6	1,141.9	-	-
Swine	47.9	58.2	8.6	9.3	10.0	-	-
Camels	43.6	56.8	9.0	7.8	7.0	-	-
All Poultry	96,882.8	127,331.7	38,549.0	54,913.0	68,114.0	-	-
Fresh milk equivalent	4,103.0	4,933.4	2,159.9	2,734.5	3,406.6	-	-
Eggs	93.4	133.9	54.7	99.1	167.3	+	+

a No allowance for seed requirements.

b Human consumption only.

c Index of all seeds based on import shares and expected production shares. Demand shown is a residual after allowance for available supplies of cottonseed.

d Figures are for animal slaughter requirements.

e Projected shortage is especially suspect.

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climatic and other natural conditions. They are only indicative of trends and magnitudes based on available data. It will be noted that shortages are forecast for many important crops, especially sugar beets/cane, livestock/poultry, oil seeds, and wheat.

These particular shortages can be forecast with some confidence due to the magnitudes involved. Considerably less confidence attaches to the remaining forecast negative values due to a paucity of data concerning production and domestic consumption of perennial and garden-type crops.

When the demand and supply balances are converted from raw agricultural crops into their equivalents in processed or semiprocessed foods, Table 2 can be created. Except for dates and cotton, supplies of traditional exports are not forecast to move very far from 1965 levels. Indeed, the production surplus of an important export, raisins, may fall. The export bright spot is the forecast potential surplus of fresh fruits, vegetables, and rice, which currently do not earn very much foreign exchange. In contrast, rather large changes are forecast on the import side. There is an implied need for heavy increases in foreign exchange requirements to finance dairy/meat and wheat flour imports.

The only way to avoid importing large amounts of animal products is to achieve a dramatic increase in domestic flocks and herds. This alternative would require imports of about one million metric tons of feed grains per year by 1980⁴.

Except for meat and animal products, Iran probably has the physical resources to become agriculturally self-sufficient. This could be achieved by 1985 (i.e., when irrigation sources have been fully exploited) if sufficient producer incentives, marketing adjustments, and physical infrastructure is in place (mainly secondary roads). Domestic transport and marketing costs are high and even primary production costs are certainly not low.

In recent years, Iranian crop production has risen in many cases, but the higher outputs have been due largely to increases in cropland harvested rather than to technical

4. The shortfall in fresh milk equivalent (Table 1) has been converted to a cheese basis simply for convenience. The cheese figure is the implied shortage that would exist if all future domestic milk production were confined to fresh uses and for ghee and yoghurt.

TABLE 2. Estimated import requirements and exportable supplies of selected agricultural products-Iran (1,000 metric tons).

Import item	1975	1980	Export item	1975	1980
Diary^a					
Cheese	117.91	131.90	Cotton (raw lint) ^f	154.81	213.02
Condensed milk and cream	0.80	0.80	Edible seeds (spices)	2.61	1.41
Dry milk and cream	8.20	8.80	Nuts (unshelled) ^g	16.40	24.13
Butter	3.00	3.50	Rice ^h	---	166.30
Meats					
Mutton and goat	63.55	76.18	Dry fruits		
Cattle and buffalo	37.91	53.67	Raisins	23.45	18.48
Poultry	36.09	49.74	Apricot-peach	10.50	17.76
Other red Meat	14.36	19.88	Dates	22.37	48.96
Fats and oils					
Lard and tallow ^b	14.28	28.23 ^b	Fresh fruit		
Vegetable oil	62.43	54.36	Citrus	---	30.48
Wheat (or flour equivalent) ^c	1368.06	1373.19	Apple, pear	---	31.47
Minor grains	64.46	76.81	Other	---	12.81
Feed grains substitute for meat & dairy ^d (maize equivalent)	854.25	1086.90	Animal Products ⁱ		
Wool (soft basis) ^e	19.63	26.19	Skins ^j	15.69	17.63
Hides	7.40	9.40	Casings	0.63	0.82
			Bone and hoof	0.59	0.68

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a Share of estimated total demand that cannot be met with expected increases in breeding flocks and herds.
 b Share of estimated demand that cannot be met by estimated increases in domestic slaughter animals.
 c After allowance for seed requirement. It is impossible to estimate relative shares of wheat and flour on the basis of Iranian data.
 d Feed grain imports at this level could substitute for all listed meat requirements. In addition, import requirements for dairy products would be reduced by an average of 70% and 44%, and for lard and tallow by 81% and 69% in 1975 and 1980 respectively.
 e Includes some hair.
 f Estimated supplies less allowance for trends in exports and domestic consumption. Iran imports cotton each year but quantities are unpredictable. No specific projections of domestic demand for raw cotton are made in this study.
 g At least 60% pistachio.
 h After allowance for seed requirement.
 i At least 90-95% of listed products annual production exported in 1965-1966. Projections of future domestic demand cannot be made with available data. However, export percentages are estimated to fall, by 1980, to 87% (skins), 85% (casings), 70% (bone and hoof). All dry basis.
 j Hides are not exported.

improvements leading to widespread attainment of greater yields. Ultimately, further increases in production must be sought in yield increasing techniques, especially in connection with supplemental and new irrigation supplies.

The study provides a basis for other general observations. For example, there is a strong tendency for imports of consumer as well as capital goods to rise faster than the rate of growth of GNP. Fairly tight controls over import licenses will probably be necessary. The current rate of population growth is higher than official estimates employed during the whole 1956-1969 period, and it will keep rising. In fact, it may rise to 3.3-3.6 percent by 1980-1985. Another feature of the analysis is much lower estimates of per capita incomes by 1975 than envisioned in the Fourth Development Plan.

DATA

Estimates of agricultural product demand are based upon patterns of food consumption, population, and income growth.

Bank Markazi Iran has conducted periodic surveys of urban consumption habits in the ten largest cities of the country. The 1956 and 1965 results were available for study purposes. Patterns of rural consumption can be estimated from a continuing survey of rural households, first begun in 1963 by the Iranian Statistical Centre. Additional rural consumption information is available from a substantial number sample families in various Ostans as reported by the Food and Nutrition Institute. The reliability of these sources in descending order are the nutrition surveys, the urban surveys, and the rural surveys.

Full scale censuses of population were conducted in 1956 and 1966. Data for 1966 became available in late 1968. The ten year enumeration interval facilitates estimates of trends in rates of rural-urban migration, changes in age-sex ratios, and other demographic characteristics bearing upon future food consumption. In the study under review, only limited use was made of raw census reports, since two analyses of the 1956 and 1966 census results were available. Both Chasteland (1) and Ronaghy (6) have predicted future urban-rural population numbers in Iran and their analyses were judged to be accurate and suitable for agricultural demand forecasts.

Bank Markazi Iran and Ministry of Economy estimates of gross national product and other monetary measures are published from time to time. (For purposes of the *Iran. Jour. Agric. Res. Vol. 2, No. 1, 1973*)

study, values of such data were extended to ten-eleven years by referring to some very early estimates made by the Plan Organization and other agencies in connection with the Third Plan).

Estimates of future supplies of agricultural products are based on past trends in annual production, planned land and water developments, and increased utilization of modern techniques and inputs.

During the period when field work was conducted in Iran, the main source for the basic pattern of farm production and organization was in published results of the 1960 Census of Agriculture. Trends in annual estimates of crop production are published by FAO, Ministry of Agriculture, Plan Organization, and may also be found in many other scattered reports. Some annual production estimates dating back to the early 1930's were found in reports filed in the World Agricultural Library (FAO) in Rome.

Estimates of increases in the amount of land that might be devoted to particular crops in future years, as well as the amount of potential new and supplemental irrigation water, were obtained from the Fourth plan Frame.

Various assumptions may be made concerning the rate of adoption of modern techniques and associated higher crop yield levels. Final values were based on rates as estimated by FAO in the I.W.P. for the Near East (4). The main source for potential yield data are Iranian fertility trials reported by the UN Development Project (2). These reports were augmented by crop studies conducted by Khuzistan Water and Power authority, the Ministry of Agriculture, the Department of Rural Sociology, Tehran University, Plan Organization, and other agencies.

Estimates of poultry and livestock numbers are found in the *Yearbook* of the Iranian Statistical Centre (8), in a private KWPA study (3), and in a USAID report by Haynes (5a, 5b).

Numerous other special crop and livestock situation reports were translated and reviewed. In addition, foreign trade statistics were obtained from Treasury publications and international sources. In all, approximately 100 references are actually cited.

METHOD

The basic format common to all agricultural supply and demand projections is that any failure of domestic supplies to meet realized demands must be accounted for in imports, and vice versa. Thus, if one assumes that future demands will be met, it is possible to forecast domestic shortages or surpluses of a particular crop in some time period by rearranging our notion of necessary export demand/supply identity:

$$HH_i = AS_i - (s_i + f_i) + M_i + (b_i + e_i);$$

where:

- HH = household consumption
- AS = crop production
- s = seed requirement
- f = livestock feed
- M_i = ag. imports less ag. exports
- b = beginning crop stocks
- e = ending crop stocks
- i = crop in question

Then:

$$\pm M_i = HH_i - AS_i - (s_i + f_i) + (b - c);$$

where $-M_i$ is interpreted as an exportable surplus.

The first requirement is to balance demand and supply for all crops in question as of some benchmark date. In the study in question, 1965 was chosen because this corresponded with the year of a large urban household consumption survey and the end of three rounds of the rural consumption survey. In addition, the benchmark is close to the 1966 Census of Population year. A better benchmark from the supply standpoint would have been 1960, the year of the national Census of Agriculture. Given the selection of 1965, however, the agricultural census results are up-dated by reviewing reported crop production trends and by allowing for apparent changes in hectares harvested and in yields.

Obviously, in many cases, values for b, c, and f are virtually impossible to obtain, so carryover stocks largely are ignored, and estimates of animal competition for products also important in human diets are confined to small grains. Prior to obtaining the benchmark balance, some consumption data must be transformed into raw product equivalents.

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For several important crops, a computed supply-demand balance was achieved immediately. In all other cases, any discrepancy was removed by adjusting production estimates for 1965 to conform with the estimated benchmark demand.

DEMAND

Future estimates of demand for any product (i) are based on projections of per capita estimates of 1965 consumption of all the various food products surveyed. The projection of demand for any one product equals:

$$c_{ti} = c_{oi} \left(\frac{y_t}{y_o} \right)^{Ni}; \quad (3)$$

where

- t = target year
- o = base year = 1965
- y = per capita income
- c = per capita consumption
- N = income elasticity of demand⁵

Values for c_{ti} are multiplied by projected population to obtain total quantities. This process is repeated for Tehran, other large cities, and rural areas. Then the results are summed into national forecasts for each food product. Once the necessary conversions are made into raw agricultural product equivalents, the demand projections are complete for the target years in question. In this case, the years are 1975 and 1980.

A major effect is devoted to estimates of N for a large number of products consumed in both urban and rural settings. These coefficients are computed by dividing consumption of each product into income classes and average household sizes per class as reported in the various consumption surveys. Then average per capita consumption of each food product is regressed on per capita incomes and average household size:

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5. This coefficient measures the percent increase in consumption due to a given percentage increase in income.

$$\ln c_i = b_{0i} + b_{1i} \ln y + b_{2i} \ln h; \quad (4)$$

where

- b_1 = income elasticity of demand,
 b_2 = household size elasticity of demand,

An econometric model of the Iranian economy, based upon future ability to pay for imports of growth-producing capital goods out of oil and other foreign exchange earnings, is included. Predictions of disposable income (y_t) in the years 1975 and 1980 are obtained from this model. These national totals are divided into three segments according to Bank Markazi estimates of GNP proportions generated in Tehran, other cities, and rural areas. Division by projected populations for the three areas yields the necessary per capita income (y_t) according to urban or rural area.

SUPPLY

Forecasts of future domestic crop and livestock supplies are developed by two methods. The first of these consists of simple extrapolations of past trends in reported annual crop production and livestock statistics. In general, these extrapolations are employed only as cross-checks on the second method, the results of which are taken to be the most accurate.

In the second method, the country is divided into 13 crop zones in order to lend substance to the assumption of homogeneous areas over which cultivation practices, varieties grown, and yield experiences are about the same. Crop production, hectares, and yields reported by Ostan in the 1960 Census of Agriculture, are redistributed to the 13 zones. These 1960 figures are updated on the basis of allowance for increased production according to 1965 estimated supply-demand balances and increases in harvested area between 1960 and 1965 as estimated by the Plan Organization. These national increases in production and hectares are forced into the proper zones partially on the basis of crop zone proportions in 1960 and partially on the basis of known shifts in production areas.

Further increases in output from these lands, that is, land more or less identified in the 1960 Census of Agriculture, are linked to possible yield increasing techniques and varieties that may be reasonably expected between 1965 and 1975 or 1980. But this does

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not account for all the potential future production, because allowance must be made for increases or improvement in irrigated lands due to completion of irrigation projects.

Potential crop increases due to irrigation projects are limited to the amount of land that will probably reach full cropping potential before 1975 and before 1980. All projects scheduled for the Fifth plan are ruled out. Projects are identified by appropriate crop zones and by percentages of project areas expected to be fully operational by 1975 and 1980. Cropping patterns are then estimated by reconciling FAO and Fourth plan predictions of total expected additions to hectares of various crops with the amount of land expected to receive the new water. This is done by "spreading" the projected national increases in crop hectares over each crop zone without exceeding the newer supplemental water hectares that will be available. Areas where certain water intensive crops such as rice predominate, for example, Gilan, are "awarded" heavier shares.

Finally, the additional production tonnages expected from new water developments are added to the basic supply projections associated with land identified in the 1960 Census of Agriculture. This is done on a zonal basis. Zone totals are then summed to obtain national supply values which may be compared with projected demands. Any projected surpluses must be reduced by seed requirements and possibly by animal feed requirements. Any shortages must be increased by the same estimates.

Future livestock and poultry numbers are assumed to be unable to increase beyond 1965 levels except to the extent that additional crop by-products become available. The likely flock and herd increase is computed in a roundabout process. Net food energy potentially available for animal use in the target years is first computed. To this is added the apparent amount of food energy obtained from range lands in the 1965 benchmark year. Then the total 1965 animal energy requirement (adjusted for expected future reductions in draft animals) is subtracted. The residuals are assumed to be the 1975 and 1980 amounts of energy available for support of greater livestock and poultry numbers. The increases in each type over and above 1965 levels are determined by allocating energy residuals on the basis of relative future demands for various meat products.

CONCLUSION

An independent appraisal of the Iran demand-supply projections probably would place it in the middle range of such works. The techniques and results are not as elegant *Iran. Jour. Agri. Res. Vol. 2, No. 1, 1973*

as found in recent German, Dutch and Danish projections which appear in the same U.S.D.A. sponsored series. On the other hand the results are not as crude as many Asian and Latin American demand-supply studies.

The weakest aspect is in projections of agricultural supplies. However, until much improved annual or seasonal livestock crop quantity and price estimates are available, better projection methods (econometrically estimated supply responses, etc.) will be difficult to apply.

Both the demand and supply sides need to take into account the influence of prices on achieving market equilibriums. What is needed is an effective mathematical model to forecast future prices. Then a system of simultaneous equations could be specified and "solved" to predict supply and demand quantities. Given the rapidity with which Iranian agricultural statistics are improving, it should soon be possible to employ such techniques. This will be especially useful for providing near-term marketing information to agricultural producers.

Finally, we must bear in mind that forecast shortages of important food items are very heavily influenced by expectations about the number of Iranians who must be fed in the future. High rates of population growth have been predicted by independent sources, but there is a strong world-wide trend for these rates to fall. If the Iranian growth rate falls, a lot of pressure on the agricultural sector could be removed by 1980.

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