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General Directorate for Development Planning and Agricultural Investments (DGPDIA)
Ministry of Agriculture, Republic of Tunisia

OUTPUT AND INPUT DEMAND RESPONSE TO PRICE AND NON-PRICE POLICY IN THE NORTH WEST PRIVATE SECTOR, TUNISIA

Final Report 91-4

July 1991

by

Jean-Paul Chavas
Michael Roth
Ali Selmi
Soubaker Thabet
Merchergui Ayda
Hamdi Larbi
Bel Haj Mosbah
Ghommam Tahar

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Ministry of Agriculture, General Directorate for Development Planning and Agricultural Investments (DGPDIA)
Project Office: Boite Postale 24, 1003 Cité El Khadra, Tunis, Republic of Tunisia • Telephone: (216-1) 681-570/573

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Jean-Paul Chavas and Michael Roth
University of Wisconsin, USA

Ali Selmi and Boubaker Thabet
INAT, Tunis

Merchergui Ayda, Hamdi Larbi, Bel Haj Mosbah and Ghommam Tahar
DGPDIA, Ministry of Agriculture, Tunis

Prime Contractor: **Abt Associates Inc.**, 4800 Montgomery Lane, Suite 500, Bethesda, Maryland 20814 • (301) 913-0500
Subcontractors: **Institut Supérieur de Gestion**, 41, Avenue de la Liberté, Cité Bouchoucha, Le Bardo, Tunis, Republic of Tunisia • (216-1) 260-378/261-854
Ithaca International Limited, 707 Cayuga Heights Road, Ithaca, New York 14850 • (607) 257-2541
University of Wisconsin International Agriculture Programs, 240 Agriculture Hall, Madison, Wisconsin 53706-1562 • (608) 262-1271

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EXECUTIVE SUMMARY

OUTPUT AND INPUT DEMAND RESPONSE TO PRICE AND NON-PRICE POLICY IN THE NORTH WEST PRIVATE SECTOR, TUNISIA

(1) Agricultural policy decisions require in-depth analysis of the economic performance of the farm sector. By improving the understanding of the competitiveness of various crop and livestock enterprises, analysts are better able to gauge the adjustments in agriculture resulting from changing economic conditions. This study examines the competitiveness of agricultural activities in the northwest private sector in Tunisia. It is aimed at gaining a better understanding of the factors and constraints influencing agricultural production decisions in the private sector. The effects of subsidy removal and other policy instruments on profitability, cropping patterns, production levels, input demand and opportunity cost of owned resources are simulated with a linear programming model developed from primary and secondary data sources.

(2) This work is part of a larger Wisconsin effort aimed at four objectives: (1) to assist the Ministry of Agriculture (MOA) in evaluating the economic performance and impacts of alternative price and institutional policies in the private sector; (2) to illustrate the usefulness of linear programming models in policy analysis; (3) to strengthen the skills of DGPDIA/MOA staff in economic modeling and linear programming techniques; and (4) to help focus data needs and strengthen linkages between the bureaus of statistics and planning in the Ministry. This work was carried out as a collaborative effort by staff of the DGPDIA/MOA, the Department of Agricultural Economics in the National Institute of Agriculture, and the International Agricultural Programs of the University of Wisconsin. The work discussed in this report follows a short-course in Operations Research Methods for Policy Analysis taught at the DGPDIA (in 1989) as well as the development of a public sector model for the north west region (in 1990).

(3) The linear programming model developed in this report examines the allocation of scarce resources in the north west private sector of Tunisia. Inputs in the model include family, temporary and permanent labor, mechanization, ammonium nitrate fertilizer, super phosphate fertilizer, potassium fertilizer, irrigation water, and herbicides, all purchased at official prices. Land in the model is sub-divided into five soil types based on differences in moisture, soil depth and topography.

(4) Activities in the model include principal sole crop and crop rotations for cereals (hard wheat, soft wheat, barley), legumes (fève), commercial vegetables (tomatoes, melons, potatoes, peppers and sugar beets), green forages (vesce avoine, barley, bersim and alfalfa), hay (wheat/barley straw and vesce avoine), ensilage (maize, sorghum and vesce-oats), and fallow (jachère travaillée and jachère paturée). Three levels of technologies are analyzed for cereal production: modern technology (relying on high levels of

fertilizer); traditional technology (no fertilizer); and an intermediate technology (which uses half as much fertilizer as the modern technology). The output of cereals, legumes, and vegetables, are sold at official prices. Forages and ensilage are produced as feedstuffs for sheep and cattle. Meat, milk, and wool produced as offtake from animal herds are sold at market prices. Wheat straw and hay can be either fed to sheep and cattle, or sold on the market.

(5) The base case solution provides the gauge for measuring the model's ability to approximate actual private sector operations. The base solution includes outputs, land use patterns, input use, and the opportunity cost of fixed resources (land, water, permanent labor, animal units) generated by the model for the base year 1987. Model results compare remarkably well with data reported in official statistics, indicating that the model provides a good representation of crop and input management decisions in the private sector.

(6) The stability of the linear programming solution provides useful insights on the possibilities for production response to price changes. On non-irrigated land for example, the northwest region has a comparative advantage in cereal production under a wide range of market prices. This reflects the relative rigidity of the food production system in face of agro-climatic constraints. Economic conditions that lower the profitability of cereals will directly affect net farm income, with only limited substitutions with other cropping enterprises.

(7) Total cereal supply tends to be inelastic (i.e. increasing the price of output by 10 percent tends to bring about a less than 10 percent change in cereal output). The elasticity of total cereal supply with respect to a proportional change in the prices of all cereals is found to be 0.44. However, the possibilities of substitutions among cereals cultivated on dry land are 6.28 for bread wheat, 0.98 for durum wheat, and 6.47 for barley. These large elasticities are generated mostly by substitutions among cereals. Changing relative prices of cereals can thus generate large adjustments in their respective productions. Yet, the aggregate grain supply response will be much smaller due to fixed land constraints in the sector. Pricing policy is thus likely to be less effective than policies aimed at stimulating investment in land-substituting technologies in increasing wheat and barley production in the long-run.

(8) Elasticities with regard to input prices also tend to be quite inelastic (i.e. a 10 percent increase in fertilizer prices tend to have a negative but small effect on net income, production and input demand). In the absence of rationing, the elasticity of total cereal production with respect to nitrogen fertilizer price or phosphate fertilizer price is -0.20. This implies that a 10 percent increase in fertilizer prices would tend to reduce cereal production by 2 percent. Also, in the absence of rationing, the elasticity of fertilizer demand (nitrogen and phosphate) with respect to nitrogen fertilizer price or phosphate fertilizer price is -0.44 and -0.41 respectively.

(9) Several policy scenarios are simulated with the model: (I) the elimination of fertilizer subsidies; (II) the effects of fertilizer rationing; and (III) the effects of credit rationing.

(10) The effects of eliminating fertilizer subsidies are simulated through increasing the price of Ammonitre from 118 D/ton to 128 D/ton, and the price of Super45 from D 110/ton to D 141/ton (Scenario I). This policy would have significant effects on the private sector. Ammonitre use falls by nearly 8%, from 60,180 tons to 55,477 tons. Use of super phosphate fertilizer falls from 62,334 to 57,845, a decline of 7%. Fertilizer use is thus quite responsive to fertilizer price levels. The area of durum wheat falls from 355.0 to 312.3 thousand ha, while its production falls 6%. Although input use is lower, higher fertilizer prices combined with lower output result in a net decrease in farm income from D 198.1 to D 195.7 million, a decline of slightly over 1 percent. Cropping patterns experience a shift away from fertilizer intensive technology towards more water intensive (fertilizer saving) technology.

(11) The agricultural surveys reveal that 35 to 45 percent of farmers in the north west region use no fertilizers. Yet the linear programming model suggests that fertilizer is profitable to apply. This suggests either credit rationing, farmers aversion to financial risk from drought, or lack of access to fertilizer due to fertilizer rationing. In order to investigate the effects of fertilizer rationing (scenario II), fertilizer used is constrained to equal 1987 levels. This generates a reduction in durum wheat production and a shift away from fertilizer intensive cropping patterns. Hiring of seasonal labor falls, along with the economic returns to family labor. However, aggregate income does not change substantially because farmers in the model use jachère to substitute for fertilizer, thus buffering the impact of higher fertilizer costs and rationing.

(12) The effect of credit rationing (scenario III) is measured through a 25 percent reduction in institutional credit. Income declines from D 198.1 to D 195.9 million dinars and durum wheat production declines from 443,302 to 338,016 tons. Forage area declines from 45,973 to 31,095 ha due to cash constraints affecting the ability to hire labor. Cropping patterns shift to less labor intensive activities. Seasonal labor falls from 2,442 to 1,700 thousand days, creating significant impacts on labor employment. Conversely, economic rents to fixed family members increase, as the credit constraint forces greater reliance on family-owned labor. Use of Ammonitre falls from 60,180 tons to 47,864 tons, while use of Super45 falls from 62,334 to 50,547 tons. The value of livestock declines sharply due to higher costs of feedstuffs. Thus credit rationing has the effect of curbing purchases of commercial inputs, lowering hiring of labor, increasing reliance on household labor, and shifting technology choice to less commercial input intensive technologies.

(13) The current model provides an illustration of the use of linear programming in economic analysis and policy planning. As the work was done in close collaboration with staff of the MOA, the process helped to strengthen linkages between staff in statistics and planning, and strengthened skills in economic and policy analysis. With the assistance of APIP, the Ministry now has the computers, the software and the skills to operate the model, update it, and use it for future policy analysis.

OUTPUT AND INPUT DEMAND RESPONSE TO PRICE AND NON-PRICE POLICY IN THE NORTH WEST PRIVATE SECTOR, TUNISIA

I. Introduction

Agricultural policy decisions require in-depth analysis of the economic performance of the farm sector. By improving the understanding of the competitiveness of various crop and livestock enterprises, analysts are better able to gauge the adjustments in agriculture resulting from changing economic conditions. This study examines the competitiveness of agricultural activities in the northwest private sector, under alternative pricing policies and institutional reforms proposed within the framework of the Tunisian structural adjustment program. It is aimed at gaining a better understanding of the factors and constraints influencing agricultural production decisions in the private sector. The effects of subsidy removal and other policy instruments on profitability, cropping patterns, production levels, input demand and opportunity cost of owned resources are simulated with a linear programming model developed from primary and secondary data sources.

This work is part of a larger Wisconsin effort aimed at four objectives: (1) to assist the Ministry of Agriculture (MOA) in evaluating the economic performance and impacts of alternative price and institutional policies in the private sector; (2) to illustrate the usefulness of linear programming models in policy analysis; (3) to strengthen the skills of DGPDIA/MOA staff in economic modeling and linear programming techniques; and (4) to help focus data needs and strengthen linkages between the bureaus of statistics and planning in the Ministry. This work was carried out as a collaborative effort by staff of the DGPDIA/MOA, the Department of Agricultural Economics in the National

Institute of agriculture, and the International Agricultural Programs of the University of Wisconsin.[1]

II. Farm Typology

Farm typology categorizes farms based on household-level characteristics. At issue is what group or sub-group of farms are being modeled that collectively comprise the private sector of the northwest region. Two choices are possible: (A) construct one representative model based on input-output coefficients of an average farm in the sector but with sector-wide resources; or (B) develop two or more sub-models of different typologies, each containing input-coefficients and resource levels unique to farms/households falling within each. One common differentiation for distinguishing farm types is by farm size; another is by mode of farming (e.g. crop vs mixed crop-livestock farming enterprises). Approach (A) is simpler, more cost effective, and avoids the very difficult problem of trying to identify data and to empirically develop the different sub-models under (B); its disadvantage is loss of variation from aggregating all farms in the sector, particularly if inter-household variation in input use and cropping patterns is high. Approach (B) enables more careful examination of policy impacts on smaller groups of households of similar type, but at greater costs of information and time.

Loss of information associated with using the representative modeling approach (A) would bo minimized if farm data exhibit little variation among farm size categories. Data on input use--triple super phosphate (Super45), ammonium nitrate (Ammonitre), compound fertilizer (compose), mechanization

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[1] The assistance of Michael Aliber, Elisa Graffy and Lisa Smith with the statistical analysis of data from the 1989 Enquête Agricole de Base is gratefully acknowledged. All are graduate research assistants in the Department of Agricultural Economics, University of Wisconsin.

(mecanisation)--and output are presented in Table 1 for durum wheat, bread wheat, barley, legumes, forages and vegetables for six size strata of farms: 0-5 ha, 5-10 ha, 10-20 ha, 20-50 ha, 0-100 ha, and 100+ ha. The set of figures in the table are mean application rates for only those farms growing the crop that use some level of the input (i.e. zeroes and missing observations excluded). Data in Table 2 are the percentage of farms growing the respective crop in each farm size category that apply some level of the input. Data in the two tables are calculated from the 1989 Enquête Agricole de Base (EAB) for gouvernorats in the northwest region. Three important points can be gleaned from the data:

First, farms regardless of farm size category tend to be operating with similar production technology. On durum wheat for example, mean input use of households using ammonium nitrate fertilizer vary between 0.95 Qx/ha (50-100 ha) and 1.25 Qx/ha (0-5 ha). Mean application rates of triple super phosphate fertilizer on durum wheat fall in the range of 0.94 Qx/ha (100+ ha) and 1.10 Qx/ha (5-10 ha, 10-20 ha). Once mechanization is used on the crop, results in the fourth column indicate that nearly the entire area is cultivated mechanically (i.e. 98-100% of the area is tilled using machinery). Durum wheat yields vary only marginally (5.36 to 6.44 Qx/ha) except for the largest farm size categories (7.28 Qx/ha for the 50-100 ha group and 9.49 Qx/ha for the 100+ ha group). The fact that mean input levels among farm size strata are similar, yet yields for larger farmers are substantially higher, suggests that larger farms either have better access to higher quality land, or to irrigation. Comparable trends are discernible for bread wheat and barley.

Second, technology diffusion has not been scale-biased. Not only do farms appear to operate with similar production technology, farms regardless of size appear to have equal access to technology. Of those farms growing durum wheat,

Table 1

Input Use and Yield by Crop and Farm Size Category[a]

		Super45 (Qx/ha)	Ammonitre (Qx/ha)	Compose (Qx/ha)	Mechanization (% Crop Area Tilled[a])	Crop Yield (Qx/ha)
Durum Wheat:	0-5 ha	1.08	1.25	1.01	99.4	6.44
	5-10 ha	1.10	1.05	0.94	99.1	6.06
	10-20 ha	1.10	1.17	0.80	99.0	6.32
	20-50 ha	1.00	0.97	0.73	99.2	5.36
	50-100 ha	1.02	0.95	0.68	97.6	7.28
	100+ ha	0.94	1.06	0.89	98.7	9.49
Bread Wheat:	0-5 ha	1.25	1.56	0.80	100.0	7.75
	5-10 ha	1.36	1.51	1.10	100.0	7.14
	10-20 ha	1.08	1.77	1.10	100.0	10.05
	20-50 ha	0.97	1.05	0.93	100.0	9.36
	50-100 ha	1.01	1.01	0.89	100.0	12.43
	100+ ha	1.00	1.24	1.13	100.0	14.52
Barley:	0-5 ha	1.05	1.05	0.63	98.6	5.27
	5-10 ha	0.93	0.91	0.53	98.0	5.29
	10-20 ha	0.98	1.05	0.54	97.9	4.71
	20-50 ha	0.94	0.86	0.75	99.6	4.71
	50-100 ha	0.99	0.79	0.72	97.7	7.68
	100+ ha	1.09	0.81	0.83	98.9	6.28
Legumes:	0-5 ha	1.13	3.89	-	-	-
	5-10 ha	0.90	0.91	-	-	-
	10-20 ha	0.96	-	-	-	-
	20-50 ha	0.95	0.42	0.75	-	-
	50-100 ha	0.91	-	1.20	-	-
	100+ ha	1.00	-	-	-	-
Forages:	0-5 ha	1.11	1.23	0.71	-	-
	5-10 ha	1.03	1.03	0.99	-	-
	10-20 ha	0.80	1.55	1.00	-	-
	20-50 ha	1.19	1.48	1.00	-	-
	50-100 ha	0.90	0.86	0.61	-	-
	100+ ha	0.96	0.93	1.17	-	-
Vegetables:	0-5 ha	1.53	1.51	2.55	-	-
	5-10 ha	1.49	1.94	1.87	-	-
	10-20 ha	1.08	1.53	0.83	-	-
	20-50 ha	1.09	1.67	0.76	-	-
	50-100 ha	1.96	1.90	-	-	-
	100+ ha	1.23	2.39	-	-	-

a. Data are the conditional mean level of input applied (zeroes and missing observations excluded). A '-' indicates no input applied by any farmers in the respective farm size category. Source: 1989 Enquête Agricole de Base.

Table 2

Percentage of Farms Using Inputs by Crop and Farm Size Category[a]

		Super45 (Qx/ha)	Ammonitre (Qx/ha)	Compose (Qx/ha)	Mechanization (% Crop Area Tilled[a])
Durum Wheat:	0-5 ha	81.2	68.6	10.0	73.3
	5-10 ha	66.5	54.6	24.9	87.1
	10-20 ha	63.2	52.7	33.5	89.7
	20-50 ha	67.8	52.3	31.3	88.1
	50-100 ha	61.5	57.3	30.6	100.0
	100+ ha	64.5	61.7	42.1	100.0
Broad Wheat:	0-5 ha	36.9	31.5	34.1	54.1
	5-10 ha	42.0	29.3	58.0	100.0
	10-20 ha	66.5	84.2	26.6	80.7
	20-50 ha	56.7	44.3	38.1	96.8
	50-100 ha	71.8	72.0	33.5	100.0
	100+ ha	62.4	71.9	37.6	100.0
Barley:	0-5 ha	60.4	42.3	3.6	70.2
	5-10 ha	62.1	45.2	9.1	76.7
	10-20 ha	52.9	39.5	17.0	69.5
	20-50 ha	54.1	37.8	17.4	83.7
	50-100 ha	69.3	66.2	19.1	83.7
	100+ ha	75.5	58.6	11.2	100.0
Legumes:	0-5 ha	50.3	2.4	-	-
	5-10 ha	48.6	2.2	-	-
	10-20 ha	56.0	-	-	-
	20-50 ha	59.5	0.5	3.3	-
	50-100 ha	46.6	-	10.6	-
	100+ ha	91.4	-	-	-
Forages:	0-5 ha	27.0	59.5	0.0	-
	5-10 ha	42.4	49.3	4.8	-
	10-20 ha	32.0	51.7	4.4	-
	20-50 ha	36.9	38.8	2.7	-
	50-100 ha	59.2	68.3	0.2	-
	100+ ha	80.0	72.7	5.3	-
Vegetables:	0-5 ha	71.5	67.8	13.6	-
	5-10 ha	37.5	29.6	25.3	-
	10-20 ha	57.8	43.6	5.3	-
	20-50 ha	53.8	54.9	5.5	-
	50-100 ha	53.2	50.1	-	-
	100+ ha	100.0	100.0	-	-

a. Data are the percentage of farms growing the crop that use some level of the respective input (zeroes and missing observations excluded). A '-' indicates no input applied by any farmers in the respective farm size category. Source: 1989 Enquête Agricole de Base.

for example, 52.3% of farms in the 10-20 ha category apply ammonium nitrate fertilizer; the highest incidence is 68.6% by the 0-5 ha category. The frequency of application for triple super phosphate fertilizer varies between 61.5% (50-100 ha) and 81.2% (0-5 ha). For bread wheat, the range is 29.3%-84.2% for ammonium nitrate fertilizer, and 36.9%-66.5% for triple super phosphate fertilizer. For barley, mean application rates are lower, and fall in a narrow range--37.8%-66.2% for ammonium nitrate fertilizer and 52.9%-75.5% for triple super phosphate. Nearly all farms use mechanization for durum wheat, with application rates somewhat smaller for the smallest farms (73.3% for 0-5 ha, 87.1% for 5-10 ha), and 100% for the largest farms. Even though technology does not appear to be scale-biased, a significant percentage of farms regardless of farm size category, use no inputs at all. To what extent this is due to fertilizer rationing in the official market, credit rationing, risk averse farmers, or high transport costs is not discernible from the data.

Third, cropping patterns are quite similar among the six farm size categories. Original data from the 1989 EAB were processed to generate land use patterns (percent land area out of total arable land) occupied by each of 12 land uses (Table 3). The largest farms (50-100 ha, 100+ ha) tend to grow higher percentages of bread wheat (8.8%, 10.3%) and forages (4.0, 10.2). The smallest farms (0-5 ha, 5-10 ha) tend to grow higher percentages of legumes (11.4%, 7.7%), olives (7.3%, 7.2%), and other crops including fallow (18.1%, 21.3%). However, for the most part, these differences are unremarkable.

Based on these three criteria--similar technology, similar technology access or diffusion, and similar land use patterns--and cost and time constraints, the decision was made to construct one sector model based on the representative farm paradigm to characterize private sector farming in the subsequent analysis.

Table 3

Cropping Patterns by Farm Size Category, Private Sector, Northwest Tunisia

	0-5 ha	5-10 ha	10-20 ha	20-50 ha	50-100 ha	100+ ha
Blé dur (durum wheat)	28.5	34.6	37.1	35.8	32.7	27.4
Blé tendre (bread wheat)	2.4	1.8	3.8	6.2	8.8	10.3
Orge (barley)	19.5	17.6	16.1	16.9	15.6	17.0
Autres Céréales (other)	0.5	0.3	0.7	1.5	1.1	2.1
Légumineuses (legumes)	11.4	7.7	5.2	2.2	3.0	6.5
Fourrages (forages)	5.6	5.0	4.5	4.0	4.0	10.2
Culture Maraîchères (vegetables)	3.4	2.1	3.1	2.5	0.5	1.0
Autre cultures (other)	2.4	1.4	1.6	1.4	3.6	6.5
Oliviers (Olives)	7.3	7.2	6.3	3.6	4.8	1.9
Ammandiers (almonds)	0.1	-	0.1	0.1	0.6	-
Autres fruitiers (other)	0.8	1.0	1.2	0.7	0.5	0.1
Autres (All remaining including fallow)	18.1	21.3	20.3	25.1	24.8	17.0

Source: Calculated from the 1989 Enquête Agricole de Base.

III. Model Description

A. Theoretical Model

The private sector covers the farming activities of private farms in the gouvernorats of Béja, Jendouba, Le Kef, Siliana and Zaghouan (i.e. the northwest region) of Tunisia. It thus excludes the resources and production activities of the public sector, specifically the Unités Cooperatives de Production, the Agro-Combinats, and the Fermes Pilotes.[2] Béja and Jendouba have a sub-humid climate (500-600 mm of rainfall per year) while Le Kef and Siliana face a semi-arid climate (350-500 mm/year). Mixed farming systems predominate throughout the region, including mainly dryland agriculture with some irrigation. The northwest (along with the northeast) is the most important cereals and livestock producing region of Tunisia. It produces 42.3% (17.2% for the northeast) of the cereals, 49.3% (45.1%) of the legumes, 29.4% (42.9%) of the forage crops, 11.8% (41.7%) of the vegetables, 4.6% (8.7%) of the tree crops, 43.9% (40.5%) of the cattle, and 27.4% (11.6%) of the sheep and goats nationwide.

Production activities of these private sector farms are modeled on the basis of the representative farm paradigm (input coefficients for an average farm but with region-wide resources), profit maximization, and exogenously determined prices. Official prices of food commodities are fixed by the government of Tunisia. Surpluses (from setting prices too high) help to augment food stocks and reduce food imports. Deficits are met by current stock reductions or by higher food imports. However, regardless of imbalances in the commodity market that may arise, prices remain fixed and the government bears the cost of adjustments in inventory.

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[2] A public sector model for the northwest region was completed during an earlier phase of this same project (Roth et. al 1991).

Assuming that net income is a linear function of producers' production decisions and that technological constraints are linear, linear programming can be used to maximize net income subject to sector constraints. In its most general form, the linear programming model can be written:

$$(1) \quad \text{Max}_x \{c'x: A\,x \leq b,\ x \geq 0\}$$

where $c'x$ is the objective function, and $(A\,x \leq b)$ represents the set of constraints that influence production decisions. Decision variables in the model are defined as:

$x =$ $(x_1,\ldots,x_n)$ is a (nx1) vector of decision variables assumed to be non-negative $(x \geq 0)$;

$c =$ $(c_1,\ldots,c_n)$ is a (nx1) vector of net income per unit of activity; c_j denotes the income (if positive) or the cost (if negative) of one unit of the j-th activity x_j, where $j = 1,\ldots,n$. In this context, $c'x = \Sigma_j(c_j x_j)$ is the total net income that is maximized.

$b =$ $(b_1,\ldots,b_m)$ is a (mx1) vector where each element b_i represents the maximum of the i-th resource available in the production process; i.e. there are m scarce resources, each being possibly a limiting factor influencing production decisions.

$A =$ $\{a_{ij},\ i = 1,\ldots,m;\ j = 1,\ldots,n\}$ is a (mxn) matrix of technical coefficients. The coefficient a_{ij} represents the quantity of resource i that is used per unit of activity x_j. As a result, $\Sigma_j(a_{ij}\,x_j)$ is the total quantity of resource i that is being used on the farm. In this context, the system of equations $A\,x \leq b$ simply states that total resource utilization $(A\,x)$ does not exceed their availability (b).

The optimization problem in equation (1) is a linear programming problem that can be solved by standard numerical methods; the Simplex method is implemented in this study using the software package HYPER LINDO. The complete model is provided in Annex A.[3] It comprises n = 519 production and marketing

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[3] The model as typed in Annex A can be read and executed by LINDO as an ASCII file.

activities, and m = 326 constraints. An abbreviated description of the model specification and data sources is provided in the following sections.

B. Objective Function

The objective function maximizes net income of private farms in the Northwest region:

Objective Function

$$(2) \quad \text{Max } \{\Sigma_k P_k Y_k - \Sigma_l w_l Z_l\}$$

where P_k denotes the official price of the k-th marketed output Y_k, and w_l is the market price of the l-th input quantity Z_l used in the production process, for k=1,...,K outputs and l = 1,...,L inputs. The first term, $\Sigma_k P_k Y_k$, measures gross income; the second term, $\Sigma_l w_l Z_l$, denotes total variable costs of production. No activities are included for receipts of income beyond those captured by model activities (e.g. private remittances or non-farm employment). The model is thus deterministic in that it excludes unanticipated changes in net income. Prices of outputs and inputs in the base model are 1987 fixed official prices.

C. Production and Marketing Activities

Activities in the model define technical possibilities of the production process. Marketable outputs include barley (orge), bread wheat (blé tendre), durum wheat (blé dur), other cereals (autre céréales), fava beans (fève-féverole), melon (pastèque et melon), peppers (piment), potatoes (pomme de terre), straw (paille), sugar beets (betterave à sucre), tomato (tomate), vesce-avoine hay (foin), milk (lait), cattle meat (viande bovins), sheep meat (viande ovins), and wool (laine). Demand for green forages {alfalfa (luzerne), barley, sorghum (sorgo), bersim (bersim ray gras), and vesce avoine} and ensilage {maize (mais), sorghum, and vesce-avoine} are derived from their value

as livestock feed, and indirectly from marketings of milk, meat and wool. Commercial inputs include seeds (semence), water (eau), ammonium nitrate 33% fertilizer (Ammonitre), triple super phosphate fertilizer (Super45), potassium fertilizer (potasse), mechanized traction (mécanisation), animal concentrates, herbicides (désherbants), and labor (family, permanent and temporary hired) (main-d'oeuvre).

D. Model Constraints

Constraints in the model reflect techniques of production and other factors that influence the choice of agricultural activities. They define land and labor constraints, crop rotations (i.e. the order in which certain crops either precede or succeed other crops in a rotation), and socio-political institutions. Certain constraints are simple accounting relationships that permit the model to calculate summary totals (total crop area, total output summed from two or more activities); they do not constrain the solution, but rather facilitate its interpretation.

Cropping patterns are differentiated according to five types of land in the model: (1) irrigated land (terre irriquée), (2) flat bottom land (terre pente faible), (3) moderately sloping topography (terre pente moyenne), (4) steeply sloping shallow soils (terre pente forte), and (5) marginal pasture land (terre paturée):

Land Constraints

(3) $\Sigma_j X_{jI} + IRRSEC \leq L_I$

(4) $\Sigma_j X_{j2} - IRRSEC \leq L_2$

(5) $\Sigma_j X_{j3} \leq L_3$

(6) $\Sigma_j X_{j4} \leq L_4$

(7) $PATUR \leq L_5$

The sum of different crop activities on each type of land cannot exceed the respective resource endowment, L_i. Cultivation of crops on flat land (L_2) and irrigated land (L_I) are influenced by water demand and supply:

(8) $\Sigma_j \, e_{jI} \, X_{jI} - EAU = 0$

(9) $EAU \leq I$

Demand for water in equation (8) is determined by number of hectares of crop activity j on irrigated land times per-hectare water requirements of the j-th activity, summed over all activities on irrigated land. Total water demanded (EAU) in equation (8) is constrained in equation (9) not to exceed total irrigation capacity (I). As long as equation (9) is non-binding and irrigation is profitable, all irrigable land (in equation 8) will be cultivated, and the amount of irrigable land tilled under dryland conditions (IRRSEC) will be zero. If on the other hand, irrigation water supply is so constraining that area cultivated ($\Sigma_j \, X_{jI}$) in equation (8) is less than the supply of irrigable land (L_I), then the remaining irrigable land switches to dryland cultivation (IRRSEC), effectively supplementing the endowment of flat bottom land (L_2).

Soil quality (depth and topography) is an important determinant of crop production. Durum wheat is normally grown on better soils (level and deep) because of its superior yield response to fertility and water. Barley is normally cultivated on poorer land (shallow soils generally on hillsides) due to its superior drought resistance. Pasture on marginal land is suitable only for livestock grazing. Sole crops and crop rotations permitted by the model on the different soil regimes are illustrated in Table 4. Regardless of the comparative advantage that a certain crop may hold on a given land type (e.g.

Table 4

Cropping Possibilities by Land Type, Tunisian Private Sector Model

	Irrigated Land	Flat Land	Moderate Sloping	Steep Slope	Pasture
Durum Wheat:					
Sole crop, BD	x	x	x	x	
Rotation with legume, BD/LG	x	x	x	x	
Rot. w/ sugar beets, BD/BS	x				
Rot. w/ worked fallow, BD/JT		x	x	x	
Rot. w/ pasture, BD/JP		x	x	x	
Bread Wheat:					
Sole crop, BT	x	x	x	x	
Rotation with legume, BT/LG	x	x	x	x	
Rot. w/ sugar beets, BT/BS	x				
Rot. w/ worked fallow, BT/JT		x	x	x	
Rot. w/ pasture, BT/JP		x	x	x	
Barley:					
Sole crop, OG		x	x	x	
Rotation with legume, OG/LG		x	x	x	
Rot. w/ worked fallow, OG/JT		x	x	x	
Rot. w/ pasture, OG/JP		x	x	x	
Other Cereals:					
Rot. with legume, AU/LG			x	x	
Rot. w/worked fallow, AU/JT			x	x	
Vesce-Avoine:					
Forage, FVVA	x	x	x	x	
Ensilage, ENVA	x	x	x	x	
Rot. w/ sugar beets, FVA/BS	x				
Hay, FNVA	x	x	x	x	
Other Forage:					
Barley forage, FVOG	x	x	x	x	
Sorghum forage, FVSG	x	x	x	x	
Bersim, BRG	x				
Alfalfa, LZ	x				
Other Ensilage:					
Maize, ENMS	x				
Sorhum, ENSG	x				
Fava Beans:					
Sole Crop, FV	x	x			
Rot. w/ sugar beets, FV/BS	x				
Sugar Beets, BS	x				
Tomato, TM	x				
Pepper, PM	x				
Potato (in-season), PDT	x				
Potato (after-season), PDTAS	x				
Melon, PQ	x				
Worked Fallow, JT		x	x	x	
Pasture Fallow, JP		x	x	x	
Pasture, PATUR					x
Tree Crops, ARBOCULT					

barley on steeply sloping land), cropping possibilities are incorporated on other land types as well to enable crop substitution with price changes.

Four principal rotations are included in the model: (a) continuous cropping of cereals; (b) cereals after a nitrogen-fixing legume; (c) cereals after worked fallow--jachère travaillée; (d) cereals after green fallow--jachère paturée. The majority of rotations span 2 years (durum wheat/legume, bread wheat/legume and barley/legume). The sole exception is a three-year rotation for sugar beets (betterave à sucre/legume/cereal).

According to the 1989 EAB, private farms in the northwest region controlled 826,400 ha of arable land (terres labourable), 116,600 ha of worked fallow (jachère travaillée), 166,000 ha of pasture fallow (jachère morte), and 96,100 ha of pasture (parcours) in 1985/86 (1986 EAB). Irrigation activities of private farms in the périmètres irriguées (but under state control) were incorporated in the earlier public sector model. Land endowments are thus determined and fixed exogenously in the model from data on total land area and observed cropping patterns: 23,000 ha of land outside the irrigated perimeters, 115,000 of flat land, 604,300 ha of moderately sloping soils, 363,000 ha of steeply sloping and shallow soils, and 96,100 ha of marginal pasture land. The total (1,201,400) roughly corresponds to land endowments reported in the EAB (1,205,100 ha).

Crop output in the model is determined by equation (10):

Crop Production

$$(10) \quad Y_k = \Sigma_j \, y_{kj} X_j$$

Production of cereals, legumes, and vegetables (denoted by Y_k) is determined by area cultivated (X_j) times yield (y_{kj}). Yields vary according to type of terrain (land quality), by technology (with and without fertilizer, with and without irrigation), and by type of rotation.

Forage Production

(11) $Y_{ft} = \Sigma_j y_{fjt} X_j + \Sigma_j y_{ft}$ PATUR

Transfer Constraints

(12) $Y_{ft} + a_{ft}T_{ft-1} - C_{ft} - T_{ft} - S_{ft} \geq 0$

$t = 1,\ldots,5$

Unlike cereals and vegetables, forage and ensilage crops may have one or more cuttings, and feed demands from livestock occur throughout the year. Equation (11) indicates that output of the f-th forage or ensilage crop in the t-th time period must equal the sum of the f-th forage or ensilage produced on cultivated land (denoted by X_j) or on pasture (PATUR). Production of the f-th forage in the t-th period (Y_{ft}) can either be consumed in the t-th period (C_{ft}), transferred to the next period (T_{ft}) or sold (S_{ft}) as in the case of hay or straw via equation (12). Consumption in the t-th period can thus be met by current period production (Y_{ft}) or transfers from the previous period (T_{ft-1}). However, transfers incur losses from spoilage over time. Green forages, by definition, must be consumed in the current period, hence $a_{ft} = 0$ for all time periods except the period in which output is produced, in which case $a_{ft} = 1$. Hay is assumed to incur a loss of 3% per period, and ensilage 5% per period. Hence, a_{ft} for each equals 1 in the period in which they are produced, and either .97 or .95 respectively in all other periods. Time periods are the same as those for disaggregating labor activities (see below).

Equations (13) through (18) represent the seasonal nutritional requirements of a female unit (unité femelle, u.f.) of pure bred cattle (BOVP), cross bred cattle (BOVC), and sheep and goats (OVIN), for forage units (unités fourragères, UF), for digestible nitrogen (matières azotées digestible, MAD), for dry matter (matieres sèches, MS), for roughage (foin, FN), and for litter

Animal Requirements

(13) $\Sigma_f \; UF_{ft} \, C_{ft} - pf_t \, BOVP_t - cf_t \, BOVC_t - of_t \, OVIN_t \geq 0$

(14) $\Sigma_f \; MAD_{ft} \, C_{ft} - pd_t \, BOVP_t - cd_t \, BOVC_t - od_t \, OVIN_t \geq 0$

(15) $\Sigma_f \; MS_{ft} \, C_{ft} - ps_t \, BOVP_t - cs_t \, BOVC_t - os_t \, OVIN_t \geq 0$

(16) $\Sigma_f \; FN_{ft} \, C_{ft} - pn_t \, BOVP_t - cn_t \, BOVC_t \geq 0$

(17) $\Sigma_f \; LIT_{ft} \, C_{ft} - pl_t \, BOVP_t - cl_t \, BOVC_t - ol_t \, OVIN_t \geq 0$

(18) $CONC_t - pc_t \, BOVP_t - cc_t \, BOVC_t \geq 0$

(litier, LIT).[4] For example, requirements of one u.f. cross bred cattle is pf_t units of forage, pd_t units of digestible nitrogen, ps_t units of dry matter, pn_t units of hay, pl_t units of litter, and pc_t units of concentrate in the t-th period. Input coefficients for nutritive value of forages and animal requirements are provided in Tables 5 and 6.

Animal Products

(19) $Y_k - y_{kp} \, BOVP - y_{kc} \, BOVP - y_{ko} \, OVIN \leq 0$

where, k = milk, meat and wool

(20) $BOVP \leq 0$

(21) $BOVC \leq 198{,}900$

(22) $OVIN \leq 1{,}199{,}110$

Output of livestock products in equation (19) is derived from the conversion rates (y) of one unité femelle in each livestock category.

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[4] Numbers of female units are calculated using the weights 1 u.f. = 1.0 vaches et genisses pleines and 0.4 autres bovins, and 1 u.f. OVIN = 1.0 brebis and .6 autres ovins. No pure breed cattle are reportedly owned by private farms.

Table 5

Nutritive Value of Forage

	Unité Fourragère (UF/tonne)	Matière Azotée Digestible (kg/tonne)	Matière Sèche (MS/tonne)
Fourrage Vert Vesce-Avoine, CFVVA	180	27	280
Foin Vesce-Avoine, CFNVA	615	74	855
Fourrage Vert Orge, CFVOG	170	19	210
Fourrage Vert Sorgo, CFVSG	190	15	235
Paturée, CFVPAT	200	26	270
Ensilage Vesce-Avoine, CENVA	200	21	300
Ensilage Mais, CENMS	265	24	290
Ensilage Sorgo, CENSG	215	16	255
Fourrage Vert Bersim Ray-Gras, CFVBRG	115	15	160
Fourrage Vert Luzerne, CFVLZ	180	30	235
Paille, CFNPAL	395	30	865

Source: INRAT, Paris, 1988, Alimentation des Ruminants, and Martin and Leanard, Principles of Field Crop Production.

Table 6

Animal Nutritional Requirements (par Unité Femelle)

		Jours par Période	Unité Fourragère (UF)	Matière Azotée Digestible (kg)	Matière Sèche (MS)
Bovine:	Period 1	61	300	25	490
	Period 2	91	445	40	730
	Period 3	91	445	40	730
	Period 4	61	300	25	490
	Period 5	61	300	25	490
Ovin:	Period 1	61	60	5	100
	Period 2	91	90	8	145
	Period 3	91	90	8	145
	Period 4	61	60	5	100
	Period 5	61	60	5	100

Source: INRAT, Paris, 1988, Alimentation des Ruminants, and INAT, Tunisia.

Conversion rates are 1.75 tons of milk and .24 tons of meat per u.f. pure bred cow, 1.25 tons of milk and .189 tons of meat per u.f. cross bred cow, .003 tons of wool and .031 tons of meat per u.f. sheep and goats. Numbers of u.f. sheep and goats (1,199,110), u.f. pure bred cattle (0) and u.f. cross bred cattle (198,900) are constrained in equations (20)-(22) to not exceed 1987 stock levels. However, while stocks cannot exceed these ceilings, optimal stocks of each category can fall as profitability declines.

Demand for commercially purchased inputs is determined by equation (23):

Traded Inputs

$$(23) \quad Z_l = \Sigma_j a_{lj} X_{lj} \qquad l=1,\ldots,L$$

Total demand for the l-th input equals the sum of input use (a_{lj}) per hectare of the j-th activity times the number of hectares of the j-th activity (X), summed over all activities. Commercial inputs include seed (SEMENCE), mechanization, ammonium nitrate fertilizer (AMMON), super phosphate fertilizer (SUP45), potassium fertilizer (POTASS), and herbicide (DESHER).

Equations (24), (25) and (26) represent the demand for and supply of agricultural labor:

Total Labor Demand

$$(24) \quad \Sigma_j a_{tj} X_j - 5.7\ SALAIR_t - 5.7\ PMHOMM_t - 5.7\ PMFEMM_t - 5.7\ FMHOMM_t - 5.7\ FMFEMM_t \leq 0$$

Fixed Family and Permanent Labor Supply

$$(25) \quad \begin{aligned} FMHOMME &\leq 37{,}950 \\ FMFEMME &\leq 25{,}590 \\ PMHOMME &\leq 12{,}800 \\ PMFEMME &\leq 450 \end{aligned}$$

$$(26) \quad \begin{aligned} FMHOMM_t &= dfh_t\ FMHOMME & \Sigma_t\ dfh &= 240 \text{ days} \\ FMFEMM_t &= dff_t\ FMFEMME & \Sigma_t\ dff &= 230 \text{ days} \\ PMHOMM_t &= dph_t\ FMFEMME & \Sigma_t\ dph &= 320 \text{ days} \\ PMFEMM_t &= dpf_t\ FMFEMME & \Sigma_t\ dpf &= 270 \text{ days} \end{aligned}$$

Labor requirements (hours) on the j-th crop or forage activity (a_{tj}) times the j-th activity (X_j) summed over all activities equals the demand for total labor in time period t (equation 24). Labor supply is comprised of family labor (male and female), permanent hired labor (male and female) and temporary hired labor. The supply of family labor is determined by the number of male and female effective workers (effectifs) in households in the region times days worked times 5.7 hours/day. Considering male adults, for example, adult male labor ($FMHOMM_t$) is calculated as number of male effectifs in the northwest region (37,950) times days worked per period (e.g. 61 days in period 1) times 5.7 hours. Family female labor and permanent labor are calculated accordingly. Private farms are able to hire temporary seasonal labor beyond this supply up to the limit of total days worked by seasonal workers reported in the 1989 EAB (2,442.2 thousand). Numbers of family male and female effectifs, male and female permanent workers, and days worked per year are taken from the 1989 EAB.

Labor supply and demand is divided into five periods of the year to capture seasonal labor bottlenecks in agriculture: (1) October-December; (2) December-February; (3) March-April; (4) June-July; and (5) August September. These periods are the same as those for transferring forage in equation (12). Time periods were chosen, and labor coefficients were determined--for land preparation (PREP), fertilizer application (EPAND), planting (SEMIS), weeding (DESHER), cutting and hauling forage (TRAVFV), cutting and raking hay (TRAVFUP), baling and hauling hay (TRAVFN), cutting and hauling ensilage (TRAVEN), harvesting grain (MOISS)--based on the cropping calendar in Table 7.

In addition to human labor, the private sector also employs mechanization, specifically traction for land preparation (TRACTION), forage cutting (MECHFV), cutting and raking of hay (MECHFN), baling of hay (PRESS), cutting ensilage (MECHEN), treatment of sugar beets (BSTRAIT), and transport (TRANS).

Table 7

Cropping Calendar

	O	N	D	J	F	M	A	M	J	J	A	S
Blé Dur		—	—	—	—	—	—	—	—	—	—	
Blé Tendre		—	—	—	—	—	—	—	—	—	—	
Orge	—	—	—	—	—	—	—	—	—	—	—	
Vesce-Avoine	—	—	—	—	—	—	—	—	—	—		
Luzerne	—	—	—	—	—	—	—	—	—	—	—	
Bersim Ray-gras	—	—	—	—	—	—	—	—				
Sorgo Fourrager	—							—	—	—	—	—
Orge en Vert	—	—	—	—	—	—	—	—				
Betterave à Sucre		—	—	—	—	—	—	—	—	—		
Tomate	—					—	—	—	—	—	—	—
Piment	—					—	—	—	—	—	—	—
Pastèque	—				—	—	—	—	—	—	—	—
Melon	—				—	—	—	—	—	—	—	—
Pomme de Terre de saison					—	—	—	—	—	—		
Pomme de Terre apres saison	—	—	—	—	—							
Fève		—	—	—	—	—	—	—	—	—		

E. Model Bounds

The model was constructed over a period of 6 months between December 1990 and June 1991. Considerable time and effort went into data documentation and model development. This effort had two outcomes: (1) model results closely approximate cropping patterns and resource use as demonstrated by the comparison of base model results and 1987 actual data in the next section; and

(2) the model required few bounds or production constraints to achieve this solution. Nevertheless, there are a number of constraints/bounds on land use in the model, reflecting mainly weaknesses in data or insufficient knowledge of agronomic practices. These constraints take the general form:

$$(27) \quad X_j \begin{matrix} \leq \\ > \end{matrix} B_j$$

Area of the j-th activity is constrained to be either greater than, less than, or equal to area B_j. Four such constraints exist in the model.

First, tree crops (ARBOCULT) are constrained to equal 82,900 ha. Attempts to fully incorporate tree crops were largely unsuccessful due to data difficulties, and because successful integration would have required a dynamic or multi-period formulation to account for their perennial cropping cycle and for adjustments in age structure of trees. Doing so would have required a major extension of the modeling effort. However, not including tree crops in the model would have created problems in balancing the labor supply and demand constraints (equations 24-26), and in completely accounting for total crop area. Tree crops are thus included in the land and labor constraints to help balance these accounting identities, yet the activity produces no output, nor does it consume other inputs. Other cereals (SUPAU) were also bound to not exceed 29,000 ha to also satisfy the land constraints.

Second, the area in dry legumes, in particular fève/féverole, is constrained to equal 57,000 ha. Compared with cereals, forages and ensilage, data on legumes was quite sparse and the associated activity(ies) in the model proved to be quite erratic. The activity is constrained until such point that its input-output characteristics and farming practices are better understood.

Third, cultivation of vegetables during the main growing season is constrained to not exceed 16,900 ha (1987 area) due either to lack of

irrigation or to highly inelastic demand in the market. The fact that vegetables are so profitable at fixed prices (yet area is only 16,900 ha), indicates the presence of constraints, but insufficient information is available to diagnose the cause or combination of causes.

Fourth, the area of individual vegetables crops--tomato, peppers, potatoes, melon and other vegetables--were constrained by equation (28) to maintain fixed proportions.

$$(28) \quad X_j = a_j \text{ CULTMAR}$$
$$j = 1,\ldots,5$$

where X_j refers to the crop area of either tomato, pepper, potato, melon or other vegetables, CULTMAR is the total area of in-season vegetables, and a_j is the fixed proportion of the j-th vegetable in the vegetable mix (i.e. a = .20 for tomato, .27 for melon, .21 for potato, .07 for piment, and .25 for other). Failure to include such a constraint would most likely result in one vegetable predominating. A number of factors are wholly or partially responsible for this phenomena: (a) labor constraints are not sufficiently refined or disaggregated to capture seasonal bottlenecks; (b) perfectly elastic demand schedules for individual vegetable crops are to some unknown extent unrealistic, and fail to incorporate either economies or diseconomies to size in vegetable marketing; and (c) agronomic constraints of multiple cropping and vegetable rotations to control for pests or disease are difficult to capture in an aggregate model. Constraints represented by equation (28) are included to help account for these realities.

IV. Yield Response

Fertilizer Demand Functions

Fertilizer demand for durum wheat, bread wheat and barley is incorporated in the model as a stepped function with curvature to study fertilizer demand response to price adjustments. The stepped function permits three levels of fertilizer use: (1) high use of fertilizer (Technologie Moderne), (2) moderate level of fertilizer use (Technologie Moyenne); and (3) no fertilizer use (Technologie Traditionnelle). Yield levels associated with each step were derived from production functions econometrically estimated from data in the 1989 EAB. Yields are farmer estimates at the beginning of the growing season. Consequently they are anticipated yields based on past experience and current judgement, but devoid of the climatic effects that arise during the growing season.

The 1989 EAB generated usable information on 1,491 private farms in the Northwest region, with an average area of 11.8 ha/farm. Among these farms, 910 produced hard wheat, 133 produced bread wheat and 746 produced barley. Yield response functions were estimated using these data to gain better understanding of factors influencing yields. The general yield response function has the form:

(29) $Y = f(N, P, MECH, SEED, HERBI, IRRIG, JACHR, GOUV5)$

where Y = Yield in Qx/ha;

N = Nitrogen fertilizer (units of nitrogen in Qx/ha);

P = Phosphorus fertilizer (units of phosphorous in Qx/ha);

MECH = Proportion of crop area mechanized (ha cultivated with machinery divided by crop area planted; 1 if all area is prepared with mechanization);

SEED = Proportion of crop area planted with improved seeds (ha planted with improved seeds divided by crop area planted; 1 if all crop area is planted with improved seeds);

HERB = Proportion of crop area receiving herbicides (ha receiving herbicides divided by crop area planted; 1 if all area receives herbicides);

IRRIG = Proportion of arable land irrigated (area of land irrigated divided by total arable land; 1 if all arable land is entirely irrigated);

JACHR = Proportion of arable land in jachère (area of jachère divided by total arable land); and,

GOUV5 = Dummy variable (1 if gouvernorat of Béja, 0 otherwise).

Nitrogen equivalents are calculated from total quantity of ammonium nitrate (Ammonitre) used times 0.33 (the percent nitrogen in Ammonitre) plus compound (Composé) fertilizer used times 0.18. Phosphate nutrient units were calculated by multiplying triple super phosphate (Super45) times 0.45 plus simple super phosphate (Super16) times 0.16 plus compound fertilizer by 0.46 to convert all three compounds into pure phosphate equivalents. Nitrogen and phosphate nutrient units are included in equation (29) to measure the impact of fertilizer use on cereal yields. The variables MECH, SEED, HERB, IRRIG and JACHR were included to control for the influence of non-fertilizer inputs and for technology. The dummy variable GOUV5 captures possible effects of agro-climatic differences across sub-regions.

Model (29) was specified as a linear function of the explanatory variables, except for the inclusion of square terms for N and P. The square terms were included in an attempt to capture the expected decreasing marginal productivity of fertilizer input. Model (29) was estimated by ordinary least squares for each of the three types of cereals: durum wheat, bread wheat and barley. The results are reported in Table 8.

The R-square varies from 0.179 for barley to 0.360 for bread wheat, which appears reasonable for cross-section data. The effect of nitrogen fertilizer (N) on crop yield is positive and highly significant; the squared-term is

Table 8

Yield Response Estimates, Tunisia Northwest Region[1]

	Durum Wheat	Bread Wheat	Barley
Intercept	7.023 (0.673)	3.911 (4.902)	6.460 (0.390)
N	17.393 (2.881)	51.266 (18.856)	4.222 (2.256)
N^2	-11.182 (2.959)	-40.804 (16.768)	-2.758 (3.228)
P	-2.995 (2.668)	-20.492 (16.364)	1.168 (1.975)
P^2	-2.538 (2.494)	9.119 (18.100)	-1.773 (3.158)
Mechanization (MECH)	0.250 (0.407)	0.874 (3.029)	0.587 (0.330)
Improved Seed	-0.476 (0.444)	-2.069 (1.878)	0.422 (0.882)
Herbicide	2.348 (0.496)	2.142 (1.846)	1.754 (0.741)
Irrigation	1.596 (0.744)	4.569 (2.839)	1.015 (1.068)
Jachère	-2.475 (0.999)	9.712 (6.625)	-0.400 (0.985)
Gouv5	-3.124 (0.419)	0.310 (2.068)	-2.552 (0.365)
Observations.	430	60	345
R^2	0.334	0.360	0.179
Standard Error	3.473	5.397	2.714

[1] Asymptotic standard errors are in parentheses below the parameter estimates.

Table 9

Estimated Yield Differences Across Technologies[1]

Technology	Durum Wheat	Bread Wheat	Barley
Technology 0	0.0	0.0	0.0
Technology 1	1.701	3.644	0.727
Technology 2	2.569	5.599	1.182

[1] Yield differences are estimated from the model reported in Table 8. Technology 0 is the "traditional technology" where no fertilizer is applied. It is used as the base case (i.e. all yield differences reported in the Table are in comparison with technology 0). Technology 2 is the "modern technology" which uses 32.1 kg N/ha, 45.0 kg P/ha for durum wheat; 36.5 kg N/ha, 47.5 kg P/ha for bread wheat; and 28.4 kg N/ha, 41.5 kg P/ha for barley. This corresponds to the average fertilizer usage by farmers using fertilizer as reported in the 1989 EAB. Technology 1 is an "intermediate" technology" where farmers use half as much fertilizer as in technology 2.

negative and also highly significant. Nitrogen fertilizer thus has a positive but declining impact on yield for durum wheat, bread wheat as well as barley, consistent with the hypothesis of declining marginal productivity. Phosphorus fertilizer is found to have an insignificant influence on yield. This may be due to collinearity problems with the other explanatory variables. Also, unlike nitrogen which is applied during the season, phosphate fertilizer is applied before or at the time of planting. Application rates per farm would thus tend to vary only marginally from year-to-year, while yields can change dramatically due to climatic changes occurring during the season. Thus, the relationship between phosphate fertilizer and yields is not as direct as for nitrogen. As expected, mechanization, herbicides and irrigation are found to have positive effects on yield, although their impact is not always significant.

The yield response estimates in Table 8 are used to investigate the impact of different technological choices on cereal yields as presented in Table 9. Three different technologies were simulated: technology 0 is the "traditional technology" where no fertilizer is applied; technology 2 is the "modern technology" which uses 32.1 kg N/ha and 45.0 kg P/ha for durum wheat, 36.5 kg N/ha and 47.5 kg P/ha for bread wheat, and 28.4 kg N/ha and 41.5 kg P/ha for barley. These rates are the average fertilizer usage of farmers using fertilizers in the Northwest region, as reported in the 1989 EAB. Technology 1 is an "intermediate technology" where farmers use half as much fertilizer as in technology 2.

Given these estimates, yields in the linear programming model were determined as follows. First, yields of cereals in cereals/legume associations are assigned eight-year averages reported in official statistics: 1.20 Qx/ha for BD/LG2H (soil type 2, H for high technology); BT/LG1H 1.90 Qx/ha; and OG/LG3H 1.15 Qx/ha. These yields assume that bread wheat has a competitive advantage on flat land (soil 1), durum wheat has a competitive advantage on moderately sloping land (soil 2), and barley on steeply sloping land (soil 3). Yields reported in official statistics are not directly comparable among crops because soil quality is not constant. Second, yields of cereals planted in continuous rotations with cereals are discounted 10% to account for the yield augmenting effects of organic matter and improved soil structure from legume rotations (fertility effects of nitrogen from legume rotations are accounted for in the fertilizer demand equations, i.e. cereals following legumes require less nitrogen fertilizer). Third, yields of jachère travaillée are increased to reflect the moisture conserving effects of this water saving technology. Yields of irrigation are also increased to reflect the effect of increased water supply. Once these yields are determined, yield differences between

high, intermediate and traditional fertilizer technologies in Table 9 were used to determine yield changes among high, medium and low technologies.[5]

IV. MODEL RESULTS

Six policy scenarios, including the base case, are simulated with the northwest private sector model. The base case or base solution (model A) provides estimates of output, land use patterns, input use, and the opportunity cost of owned resources (land, permanent labor, animal units) for the private sector in the base year 1987. Model results from the base case solution are first validated with data on area cultivated and input use reported for the organized public sector in the 1989 EAB. The base model is then used to simulate the impact of three policy experiments: (B) eliminating producer input subsidies on fertilizer; (C) evaluating economic costs of fertilizer rationing (restrictions of fertilizer access); and (D) evaluating credit rationing in the institutional banking sector.

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[5] The problem is more difficult because of multiple soil types included in the model, and because bread wheat is more responsive to water/fertility than durum wheat, and both are more responsive than barley. Yield differences between high, intermediate and traditional technologies by soil type are based on the following margins (Qx/ha). Note that yields in the model (Annex A) are in tons):

	IRR	Soil 1	Soil 2	Soil 3
Bread Wheat:				
Between moderate and high	1.96	1.96	0.91	
Between traditional and moderate	3.64	3.64	1.73	
Durum Wheat:				
Between moderate and high	1.65	1.65	0.87	0.41
Between traditional and moderate	3.23	3.23	1.70	0.81
Barley:				
Between moderate and high	1.33	1.33	0.83	0.52
Between traditional and moderate	2.59	2.59	1.62	1.01

Factor weights (ratio of yield differences between soil types) are 2.1 for bread wheat, 1.9-2.1 for durum wheat, and 1.6 for barley. The higher the weight, the more responsive the crop to improved soil water and fertility

A. Base Solution and Model Validation

The Enquête Agricole de Base provides important information on crop area, fertilizer use, animal stocks, family and permanent workers, and land endowments at the level of gouvernorats, hence regions. The Annuaire des Statistiques Agricoles reports in addition crop and livestock production, input use and crop area, but only at the national level of Tunisia.

Lacking production data, base model results are contrasted only with available data on crop area and resource use in Table 10. Despite the absence of bounds on cereals, forage crops, and jachère in the model, the solution closely approximates actual cropping patterns. Crop area of durum wheat, bread wheat, barley, green forage, ensilage, worked fallow and pasture fallow diverge from actual respective crop areas by 5 percent or less. These crops represent nearly 85 percent of total crop area. The fact that total crop area (1,203,900 ha) estimated by the model is so close to actual cropping patterns (1,215,800 ha) mainly reflects the size of land endowments chosen for land constraints in the model. The difference is due to 11,900 ha of "other crops" that were not incorporated into the model.

Model results for fertilizer substantially over-estimate actual usage. The prediction of nitrogen fertilizer use (60,180 tons) exceeds actual use by nearly 18%. Usage of super phosphate by the model exceeds actual use by nearly 28%. These results are not entirely unexpected. Earlier data reported in Table 2 indicated that around 35%-45% of farms use no fertilizer at all, while mean fertilizer levels in the model are benchmarked (for modern technology) at the mean use rates of users. The model is implicitly assuming that all farmers in the sector find fertilizer profitable to apply. The fact that they do not suggests either financial constraints, farmers aversion to financial risk from drought, or lack of access to fertilizer due to fertilizer rationing. The effect of these constraints is examined in a subsequent section.

Table 10

Model Validation, Northwest Private Sector Model[1]

	Actual 1987 Official Figures	Base Case Model Results
Crop Area (ha):		
Durum Wheat/Blé Dur	351,500	355,021
Bread wheat/Blé tendre	56,100	58,000
Barley/Orge	139,900	140,050
Oats and other/Avoine and other	29,000	29,000
Dry beans/Légumineuse en sec	57,000	57,000
Green forage and ensilage, Fourrages	89,400	83,323
Vegetables/Cultures maraîchères	19,400	19,400
Tree crops/Arboriculture	82,900	82,900
Other crops/Autres cultures		-
Worked fallow/Jachère travaillée	116,600	116,606
Pasture fallow/Jachère paturée	166,000	166,500
Parcours	96,100	96,100
Total area/Superficie totale	1,215,800	1,203,900
Fertilizer (tons):		
Nitrogen fertilizer/Ammonitre	51,180	60,180
Phosphate fertilizer/Super45	48,760	62,333
Potassium/Potasse	180	1,940
Engrais composé	20	-
Animal products (tons):		
Cattle meat/Viande bovine	37,766	37,592
Lamb meat/Viande ovins	37,733	37,172
Milk/Lait bovine	246,500	248,625
Labor:		
Family male effectifs (active workers)	37,950	37,950
Family female effectifs (active workers)	25,590	25,590
Permanent male workers (active workers)	12,800	12,800
Permanent female workers (active workers)	450	450
Temporary workers (000 jours)	2,442.2	2,442.2

[1] Actual figures on cropping patterns, fertilizer use, animal products and labor are taken from the 1989 Enquête Agricole de Base.

Demand and supply of permanent and temporary labor require very careful benchmarking between labor demand (hours per crop per ha) and labor supply (i.e. hours worked per day, wage rates--assumed constant at 3 dinars/day for all labor categories--days worked per year and number of family and permanent workers). The fact that cropping patterns are so accurate, is fairly reliable evidence that demand and supply are in balance (although both in tandem may be biased upward or downward). The only uncertainty in this equation is the number of hours worked per day (all other data are confirmed in the 1989 EAB). The choice of 5.7 hours per day was adjusted to help bring into balance labor demand and supply.[6]

Finally, output of animal products nearly exactly equals observed production patterns. This result also is not unexpected. Animal stocks are fixed at 1987 levels, and output coefficients (for meat, milk and wool) were calculated as 1987 outputs divided by these respective stock levels (unité femelle). Nonetheless, the fact that nutrition provided by production of straw, forage, and ensilage balance with animal requirements, while maintaining realistic shadow prices for livestock (D 236/u.f. bovine, and D 33/u.f. ovin) indicates that the model is doing very well on capturing economic decisions of the sector with regards to the livestock economy.

B. <u>Analysis of Supply Elasticities</u>

The base model solution can be used to investigate the relative effectiveness of pricing policy in influencing agricultural production. Certain prices in the base model have been doubled one at a time and the corresponding solution compared with the base solution. This allows a

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[6] For sake of reference, similar adjustments in the northwest public sector model resulted in the assumption of 5.2 hours worked per day by permanent and seasonal laborers.

numerical evaluation of the sensitivity of production decisions to changing market prices. This evaluation can be summarized in terms of elasticities, which measure the percentage change in the dependent variable (e.g. net income, production) resulting from a one percent change in a given price. In the case where the price is doubled, this elasticity is computed simply as $[(y_1-y_0)/y_0]$ where y_1 (y_0) is the value of the dependent variable after (before) the price change. Adjustments in these variables are examined in relation to changes in the price of durum wheat, bread wheat, barley, cereals (defined as proportional change in all three cereal prices), nitrogen fertilizer, phosphate fertilizer, potash, and herbicide.

The price elasticities are reported in Table 11. Dependent variables in the table are net farm income; the opportunity cost of land (by soil type); production of durum wheat, bread wheat, barley and total cereals; demand for nitrogen fertilizer, phosphate fertilizer, potash and for all fertilizers; and demand for herbicides. Results in Table 11 indicate that cereal prices can have a large impact on the private sector. A rise in the durum wheat price, for example, has an important effect on net income (with an elasticity of 0.67) and on the value of land (with elasticities varying between 1.9 and 3.7). Similar results are obtained with the bread wheat price, except that the elasticity of land value is lower on steep slope. This reflects the fact that bread wheat is better adapted to soils of zero to medium slope with superior water retention and fertility. Barley price has a positive effect on net income (with an elasticity of .20). The elasticity of land value with respect to barley price is 1.06 for zero slope, 1.96 for medium slope and 3.06 for steep slope, indicating that barley is better adapted to steep slopes than is bread wheat.

Table 11

Elasticities With Respect to Output Prices

	Durum Wheat Price	Bread Wheat Price	Barley Price	Cereal Price
Net Income	0.67	0.55	0.20	0.74
Opportunity Cost of Land:				
Flat or zero slope	1.93	2.12	1.06	2.13
Medium slope	3.71	3.09	1.96	2.71
Steep slope	1.94	0.36	3.06	3.30
Production:				
Cereals	0.29	0.26	0.39	0.44
Durum wheat	0.98	-1.00	-1.00	0.33
Bread wheat	-1.00	6.28	-1.00	0.50
Barley	-1.00	-.57	6.47	0.76
Inputs:				
Fertilizers	0.63	0.47	0.41	0.44
Nitrogen fertilizer	0.67	0.50	0.43	0.47
Phosphate fertilizer	0.64	0.47	0.42	0.48
Potash	-0.87	-0.53	-0.33	-0.87
Herbicides	0.19	0.14	-0.01	0.12

Table 12

Elasticities With Respect to Input Prices

	Nitrogen Fertilizer Price	Phosphate Fertilizer Price	Potash Fertilizer Price	Herbicide Price
Net Income	-.03	-.03	-.01	-.04
Opportunity Cost of Land:				
Flat or zero slope	-.02	-.02	0.00	-.04
Medium slope	0.06	0.06	0.06	0.00
Steep slope	0.12	0.12	0.00	-.06
Production:				
Cereals	-.20	-.20	0.00	-.10
Durum wheat	-.30	-.30	0.00	-.18
Bread wheat	-.01	0.00	0.00	0.00
Barley	0.00	0.00	0.00	0.11
Inputs:				
Fertilizers	-.42	-.41	0.00	-.04
Nitrogen fertilizer	-.44	-.44	0.00	-.04
Phosphate fertilizer	-.41	-.41	0.00	-.04
Potash	0.00	0.00	0.00	0.00
Herbicides	-.09	-.09	0.00	-.16

The results reported in Table 11 also show that cereal prices can have a significant effect on fertilizer and herbicide demand. In the absence of rationing, the elasticity of fertilizer demand with respect to cereal price varies between 0.41 and 0.63. These elasticities are higher than those reported in the Northwest public sector model due to the more sophisticated nature of its fertilizer demand formulation. Fertilizer demands in the public sector model comprised only one level of fertilizer per crop technology. Fertilizer demand functions in this model permit farmers to choose lower levels of fertilizer application, rather than simply using it or not. Higher cereal prices thus induce some switch toward more fertilizer intensive technologies (especially for barley). The elasticities of herbicide demand with respect to cereal price are 0.19 for durum wheat, 0.14 for bread wheat and -0.01 for barley.

The effect of higher cereal prices on cereal production is quite revealing. First, the supply elasticity of each type of cereal is fairly high: 0.98 for durum wheat, 6.28 for bread wheat and 6.47 for barley. Cross price elasticities are also high and negative, indicating strong possibilities of substitution among cereals. For example, the elasticity of production of durum wheat with respect to bread wheat price or barley price is -1.00. Table 11 indicates that a 10 percent increase in the price of durum wheat would increase durum wheat production by 9.8 percent, and would decrease bread wheat or barley production by 10 percent.

These results suggest that total cereal production is quite responsive to cereal prices. However, the response of <u>total</u> cereal production due to a proportional change in all three cereal prices is very inelastic at only 0.44. It shows that the important possibilities of substitution mentioned above are <u>among cereal types</u> while the possibilities of substitution between cereals and

other crops are more limited. As in the context of the public sector model, this shows that cereals have a comparative advantage in the northwest region of Tunisia compared to other crops, i.e. cereal production appears to be profitable in the northwest region under a wide range of market conditions.

The effects of fertilizer and herbicide prices on the same dependent variables are reported in Table 12. As indicated by the elasticity estimates, the effect of their prices is rather inelastic. Input prices tend to have a negative influence on net income, production and input demand. In the absence of rationing, the elasticity of total cereal production with respect to nitrogen fertilizer price or phosphate fertilizer price is -0.20. This implies that a 10 percent increase in fertilizer prices would tend to reduce cereal production by 2 percent. Also, in the absence of rationing, the elasticity of fertilizer demand (nitrogen and phosphate) with respect to nitrogen fertilizer price or phosphate fertilizer price is -0.44 and -0.41 respectively.

Such effects are larger than those identified in the public sector model mostly because of the more explicit modeling of technological choices considered here. For example, it is found that higher fertilizer prices give an incentive to implement technologies that are less fertilizer intensive and have lower yields (especially for durum wheat). Finally, an increase in herbicide price is found to have a negative effect on cereal production (with an elasticity of -0.10), on fertilizer demand (-0.04) and on herbicide demand (-0.15).

C. Policy Simulations

The policy study of the northwest public sector focused on direct government interventions in the northwest region, specifically the budgetary impacts associated with reducing public sector employment, impacts on eliminating land use or production quotas on vegetables and sugar beets, and

the effect of irrigation water rationing in the irrigated perimeters. These issues are not as pertinent to the private sector, because of less direct government regulation (activities of private sector farmers in the irrigated perimeters were incorporated in the public sector model). More important for the private sector are issues of market access, and income effects associated with input availability and pricing policy. Two other key differences distinguish the two models: the private sector model explicitly treats family labor as a fixed resource (the public sector mainly hires labor); and, yield response functions for three levels of fertilizer use were incorporated in the model. Whereas fertilizer demand in the public sector is based on constant technology (one fertilizer level per crop activity), fertilizer demand in the private sector includes options for high, medium and low levels of fertilizer use depending on prices. Simulations with the model indicate that fertilizer demand is much more sensitive to output and fertilizer prices than was indicated by the public sector model, and price policy has a greater impact on input use and production than were shown for the public sector.

The private sector model permits the analysis of a wide range of policy variables including changes in prices, resource levels (e.g. land, labor, livestock), technology (i.e. a_{ij} coefficients in equation (1)), institutional constraints (restrictions on irrigation water, land use patterns), market access (quotas on outputs and inputs) and so on. Policy simulations permit either separate or joint adjustment in these policy variables. Three indicative policy experiments are examined here: (B) eliminating fertilizer subsidies; (C) evaluating the economic cost of restrictions on farmers' access to fertilizer; and (D) evaluating the economic costs of credit rationing in the institutional credit sector. Model results are reported for crop area and output in Table 13, for input use and the opportunity cost of resources in

Table 14, and for specific crop technologies in Table 15. However, it should be recognized that the model is sufficiently flexible to permit evaluation of a much more sophisticated and wider array of policy experiments than those examined here.

Eliminate Fertilizer Subsidies

This scenario evaluates the impact of raising prices of Ammonitre and Super45 paid by farms in the private sector to 1989 levels thereby eliminating implicit fertilizer subsidies. The price of Ammonitre fertilizer is increased 8.5 percent from 118 D/ton to 128 D/ton. The price of Super45 fertilizer is increased 28.2 percent from 110/ton to 141 D/ton. All other prices and technical parameters remain the same.

Results of the simulation indicate that, in the absence of fertilizer rationing, use of Ammonitre falls by nearly 8%, from 60,180 tons to 55,477 tons. Use of super phosphate fertilizer declines from 62,334 to 57,845, a decline of 7%. As indicated in the earlier section, fertilizer use is quite responsive to fertilizer price levels. Although input use is lower, however, higher fertilizer prices combined with lower output result in a net decrease in farm income from D 198.1 to D 195.7 million, a decline of slightly over 1 percent.

The area of durum wheat falls from 355.0 to 312.3 thousand ha, while the area of other crops remain the same. Quite dramatic shifts occur with regard to choice of technology. Under the base case, a sizable portion of durum wheat is grown in continuous cultivation. With higher prices, the area under continuous cultivation falls from 208.9 to 123.4 thousand ha, while the area planted in association with jachère travaillée increases from 116.6 to 159.4 thousand ha. Higher costs of fertilizer thus lead to a shift toward fertilizer saving and more water intensive technology (jachère travaillée). This option

Table 13

Impacts of Alternative Policy on Crop Area and Output, Northwest Private Sector

	Base Case	Eliminate Fertilizer Subsidies	Economic Cost of Fertilizer Rationing	Economic Cost of Credit Rationing
	A	B	C	D
Net Private Sector Income (000 D)	198,088	195,714	197,399	195,960
Crop Production (tons):				
Blé dur	443,302	415,416	404,610	338,016
Blé tendre	110,000	110,000	110,000	110,000
Orge	126,045	126,045	126,045	126,045
Autres céréales	31,900	31,900	31,900	31,900
Fève	57,000	57,000	57,000	57,000
Tomate	66,586	66,586	66,586	66,586
Pastèque	53,843	53,843	53,843	53,843
Pomme de terre	59,474	59,474	59,474	59,474
Piment	8,399	8,399	8,399	8,399
Other vegetables	63,375	63,375	63,375	63,375
Paille	75,609	0	0	0
Animal Sales/Output (tons):				
Lait	248,625	248,625	248,625	248,625
Viande bovine	37,592	37,592	37,592	37,592
Viande ovin	37,172	37,172	37,172	37,172
Laine	3,597	3,597	3,597	3,597
Superficie (ha):				
Cereals:				
Blé dur	355,020	312,273	322,563	257,603
Blé tendre	58,000	58,000	58,000	58,000
Orge	140,050	140,050	140,050	140,050
Autres céréales	29,000	29,000	29,000	29,000
Fève	57,000	57,000	57,000	57,000
Culture maraîchères	19,400	19,400	19,400	19,400
Fourrages				
Vert	45,973	45,973	45,973	31,095
Ensilage	37,350	37,350	37,350	37,350
Jachère travaillée	116,607	159,354	149,064	120,952
Jachère paturée	166,500	166,500	166,500	274,450
Parcours	96,100	96,100	96,100	96,100

Table 14

Impacts of Alternative Price Policy on Input Use and Resource Opportunity Costs, Northwest Private Sector

	Base Case	Eliminate Fertilizer Subsidies	Economic Cost of Fertilizer Rationing	Economic Cost of Credit Rationing
	A	B	C	D
Price ammonitre (D/ton)	118	128	118	118
Price super 45 (D/ton)	110	141	110	110
Input Use:				
Ammonitre (tons)	60,180	55,477	45,857	47,864
Super 45% (tons)	62,334	57,845	48,760	50,547
Potass (tons)	1,940	1,940	1,940	1,940
Eau in-season (000 m^3)	150,929	150,929	150,929	150,929
Eau apres-saison(000 m^3)	10,000	10,000	10,000	10,000
Temporary labor (000 days)				
October-November	0	0	0	0
January-February	0	0	0	0
March-May	2,180	1,880	1,882	1,496
June-July	262	239	241	204
August-September	0	0	0	0
Mécanisation (000 heures)	4,705	4,564	4,598	3,991
Opportunity Cost of Resources				
Family Labor: Men (D/yr)	373	365	365	389
Family Labor: Women (D/yr)	357	350	350	373
Permanent Labor: Men (D/yr)	-537	-548	-548	-584
Permanent Labor: Women (D/yr)	-453	-462	-462	-492
Terre irriguée (D/ha)	393	400	407	390
Terre pente faible (D/ha)	131	131	132	126
Terre pente moyenne (D/ha)	56	56	56	53
Terre pente forte (D/ha)	33	35	37	32
Terre paturée (D/ha)	21	22	22	22
Bovine croisee (D/u.f.)	237	232	228	219
Ovin (D/u.f.)	33	32	31	31

Table 15

Impacts of Alternative Policies on Technology Choice by Land Type
Northwest Private Sector

	Base Case	Eliminate Fertilizer Subsidies	Economic Cost of Fertilizer Rationing	Economic Cost of Credit Rationing
	A	B	C	D
Terre Irriguée:				
Tomato (TMI)	3,380	3,380	3,380	3,380
Pepper (PMI)	1,183	1,183	1,183	1,183
Pastèque (PQI)	4,563	4,563	4,563	4,563
Pomme de terre (PDTI)	3,549	3,549	3,549	3,549
Pomme de terre (PDTASI)	2,500	2,500	2,500	2,500
Other vegetables (SUPACMI)	4,225	4,225	4,225	4,225
Ensilage sorgho (ENSGI)	6,100	6,100	6,100	6,100
Terre Pente Faible:				
Blé tendre (BT1H)	1,000	1,000	1,000	1,000
Blé tendre (BT/LG1)	57,000	57,000	57,000	57,000
Fève (FV1)	57,000	57,000	57,000	57,000
Terre Pente Moyenne:				
Blé dur (BD2H)	208,902	123,409	97,555	
Blé dur (BD2M)			46,433	
Blé dur (BD/LG2H)	3,062	3,062	3,062	2,250
Blé dur (BD/JTH)	116,607	159,354		120,952
Blé dur (BD/JTM)			149,064	
Blé dur (BD/JP2H)	26,450	26,450	26,450	134,400
Autres céréales (AU/LG2)	29,000	29,000	29,000	29,000
Vesce-avoine forage(FVVA2)	812	812	812	
Orge forage (FVOG2)	19,076	19,076	19,076	5,010
Sorgum forage (FVSG2)	26,085	26,085	26,085	26,085
Ens vesce avoine (ENVA2)	31,250	31,250	31,250	31,250
Jachère travaillée (JT2)	116,607	159,354	149,064	120,952
Jachère paturée (JP2)	26,450	26,450	26,450	134,400
Terre Pente Forte:				
Orge (OG/JP3T)	140,050	140,050	140,050	140,050
Jachère paturée	140,050	140,050	140,050	140,050
Arboriculture	82,900	82,900	82,900	82,900
Paturée	96,100	96,100	96,100	96,100
Total cultures	1,203,901	1,203,902	1,203,901	1,203,899

is effective, however, only as long as surplus land is available. Shadow prices of fixed land resources increase marginally as more idle jachère is brought into production. Opportunity costs of fixed animal stocks decline slightly due to higher costs of feedstuffs (from less straw) in animal rations.

Fertilizer Rationing

Analysis of fertilizer use by farms in the private sector revealed that between 35% to 45% of farms regardless of farm size use no fertilizer. Use rates are higher on wheat and lower for barley. As mentioned earlier a number of causes might explain this phenomena; one issue in particular is whether farmers have access to fertilizer on a timely basis in the official market. Constraints are imposed on fertilizer supply in the model to evaluate the economic costs associated with fertilizer rationing, and the impact of tight fertilizer allocations on agricultural land use, production, and income (fertilizer is constrained to equal 1987 levels--51,180 tons Ammonitre, and 48,760 tons Super45.

Production of durum wheat falls from 443.3 to 404.6 thousand tons, and its area declines from 355.0 to 322.6 thousand ha. As with the fertilizer subsidy Scenario (B), a technology shift occurs away from fertilizer intensive cropping patterns (continuous wheat cultivation, BD2H) toward less fertilizer intensive technologies (continuous wheat with half the fertilizer). There is also substitution of water for fertilizer in the form of water saving technology (wheat in association with jachère travaillée). Hiring of seasonal labor falls from 2,442 thousand days to 2,123 thousand days due to lower labor demands from less wheat production. Economic returns to family workers also fall (from D 373 to 365/male worker and from D 262 to 241/female worker) due to lower output and farm income. Thus assuming that some rationing is occurring, increasing fertilizer availability to non-ration levels (as indicated in the

base case), would increase farm incomes of family workers by about 2% (for males). Aggregate income would not change substantially. These low response rates simply suggest that farmers are using presence of jachère to substitute for fertilizer, thus buffering the impact of higher fertilizer costs and rationing.

Credit Rationing

Credit is important for relaxing cash flow constraints on purchase of producer inputs during the agricultural season. While eliminating input subsidies first and foremost affects utilization of the input directly involved, credit constraints affect use of all purchased inputs. Credit from institutional sources is constrained in scenario (D) to be 75% of optimal credit in the base model solution (D 115 million) to examine the effect of credit rationing on agriculture.

Model adjustments are profound. Income declines from D 198.1 to D 195.9 million dinars and durum wheat production declines from 443,302 to 338,016 tons. Forage area declines from 45,973 to 31,095 ha due to cash constraints affecting the ability to hire labor. Cropping patterns shift to less labor intensive activities; e.g. continuous cultivation of durum wheat is replaced by durum wheat in rotations with jachère travaillée and jachère paturée. The latter is both labor saving yet provides grazing for livestock. Use of purchased inputs decline. Seasonal labor falls from 2,442 to 1,700 thousand days, creating significant impacts on labor employment. Conversely, economic rents to fixed family members increase, as the credit constraint forces greater reliance on family-owned labor (economic returns to one male effectif increase from D 373 to D 389; rents for one female worker increase from D 357 to D 373). Use of Ammonitre falls from 60,180 tons to 47,864 tons, while use of Super45 falls from 62,334 to 50,547 tons. The value of livestock declines sharply due

to higher costs of feedstuffs (the opportunity cost of one bovine croisée decreases from 237/u.f. to D 219/u.f.). Land values also fall. Thus credit rationing has the effect of curbing purchases of commercial inputs, lowering hiring of labor, increasing reliance on household labor, and shifting technology choice to less commercial input intensive technologies.

VI. CONCLUSION

The modeling exercise presented here illustrates that a linear programming model of the agricultural sector can provide a good representation of the economic decisions facing private farms in the Northwest region of Tunisia. Its development has helped provide insights into technology availability and resource constraints influencing farm production decisions. The model was used to estimate the responsiveness of agricultural activities and income to changing market prices. This information is especially valuable when prices are influenced directly by agricultural policy (e.g. the elimination of fertilizer subsidies). The model was also used to evaluate the effects of market imperfections on the private farm sector. In particular, it was shown how fertilizer rationing and credit rationing can affect farm production decisions.

The analysis further illustrates how the modeling exercise can help improve researchers and policy makers' understanding of the factors that influence farmers' behavior, and better anticipate the effects of agricultural policy on supply-demand adjustments and on farm income. It points the way for further use and refinement of the approach by the staff of the DGPDIA. The Tunisian Ministry of Agriculture now has computer hardware and software and the experience to use and further develop linear programming models of the farm sector in the context of the economic and policy analysis of Tunisian agriculture.

Annex A

Tunisia Northwest Private Sector Model

NWPRIV6, Base Case
June 2, 1991

SECTEUR PRIVE - REGION DU NORD-OUEST, TUNISIE

I. Produits

A. Céréales:

BD = Blé Dur (tn)
BT = Blé Tendre (tn)
OG = Orge (tn)
AU = Autres Céréales (tn)

B. Cultures Maricheres:

BS = Betterave Sucre (tn)
TM = Tomate (tn)
PQ = Pastèque et Melons (tn)
PDT = Pomme de Terre de Saison (tn)
PDTAS = Pomme de Terre d'Apres S. (tn)
PM = Piment (tn)

C. Fourrages en Vert:

FVVA = Vesce A. en Vert (tn)
FVOG = Orge en Vert (tn)
FVSG = Sorgo en Vert (tn)
BRG = Bersim Ray-Gras (tn)
LZ = Luzerne (tn)

D. Ensilage:

ENMS = Ensilage Mais (tn)
ENSG = Ensilage Sorgho (tn)
ENVA = Ensilage Avoine (tn)

E. Foin:

FNVA = Vesce Avoine (tn)
PAL = Paille (tn)

F. Jachère:

JT = Jachère Travaillée (ha)
JP = Jachère Paturée (ha)

G. Legumineuses:

FV = Fève et Fèveroles (tn)

H. Elevage (Unité Femelle):

BOVP = Bovins Race Pure

VIANDBP = Viande (tn)
LAIT = Lait (tn)

BOVC = Bovins Race Croisée

VIANDBC = Viande (tn)
LAIT = Lait (tn)

OVIN = Ovins

VIANDOV = Viande Ovin (tn)
LAINE = Laine (tn)

II. Ressources

A. Périodes

1 = Octobre - Novembre
2 = Decembre - Février
3 = Mars - Mai
4 = Juin - Juillet
5 = Août - Septembre

```
!  B. Main d'Ouevre:
!
!     FMHOMME    = Main d'Oeuvre Familiale--Hommes (Effectif)
!     FMFEMME    = Main d'Oeuvre Familiale--Femmes (Effectif)
!     PMHOMME    = Salariés Permanents--Hommes (Effectif)
!     PMFEMME    = Salariés Permanents--Femmes (Effectif)
!     SALARI     = Salariés Temporaires (No. de jours)
!
!     FMHOMM_    = Main d'Oeuvre Familiale--Hommes, Périodes _     ('000 jours)
!     FMFEMM_    = Main d'Oeuvre Familiale--Femmes, Périodes _     ('000 jours)
!     PMHOMM_    = Main d'Oeuvre Familiale--Hommes, Périodes _     ('000 jours)
!     PMFEMM_    = Main d'Oeuvre Familiale--Femmes, Périodes _     ('000 jours)
!
!     PREP_      = Préparation du Sol, Périodes _            (heures/ha)
!     EPAND_     = Epandage des Engrais, Periodes _          (heures/ha)
!     SEMIS_     = Semis, Periodes _                         (heures/ha)
!     DESHER_    = Désherbage ou Binage, Periodes _          (heures/ha)
!     MOISSN_    = Moisson et Ouvrier Remorque, Periodes _   (heures/ha)
!
!  C. Traction:
!
!     TRACTN_    = Traction, Périodes _                                (heures)
!                      (Labour Profond)
!                      (Recroisement)
!                      (Epandage des Engrais)
!                      (Roulage)
!                      (Traitement)
!
!     FOUROU_    = Fouchage et Rattelage, Périodes _                   (heures)
!     RECFV_     = Recolté Fourrage Vert, Périodes _                   (heures)
!     RECEN_     = Recolté Ensilage, Périodes _                        (heures)
!     PRESS_     = Pressage (balles foin et paille), Périodes _        (heures)
!     MOISS_     = Moisson, Périodes _                                 (heures)
!     TRANSPT_   = Transport Paille et Récolte, Périodes _             (dinar/tonne)
!     BSTRAIT    = Traitement Betterave  Sucre                         (heure)
!
!  D. Terre:                          E. Autres Ressources:
!
!    3 = Pente Forte      (ha)          EAU      = Eau          ('000 m3)
!    2 = Pente Moyenne    (ha)          AMMON    = Ammonitro    (tn)
!    1 = Pente Faible     (ha)          SUP45    = Super 45%    (tn)
!    I = Irriguée         (ha)          POTASS   = Potasse      (tn)
!                                       TOTDESH  = Desherbant   ('000 dinars)
!
!  F. Credit:
!
!    CREDINST  = Credit Institionnel        ( 8%)
!    CRDNINST  = Credit Noninstitutionnel   (15%)
!
!  G. Technologie:
!
!    H = Technologie Moderne
!    M = Technologie Moyenne
!    T = Technologie Traditionnelle
!
```

```
!*****************************************************************************
!
!  Fonction Objectif du Modele: Maximiser le Revenu Net du Secteur
!
!*****************************************************************************
!
 MAX
    185 PRODBD  +   170 PRODBT  +   120 PRODOG  +   110 PRODAU  +   530 PRODFV
 +   27 PRODBS  +   100 PRODTM  +   150 PRODPQ  +   220 PRODPDT +   300 PRODPM
 +  125 PRODACM +    50 FOIN1   +    55 FOIN2   +    50 FOIN5   +    25 PAILLE1
 +   30 PAILLE2 +    20 PAILLE5 +   200 LAITBP  +   200 LAITBC  +  1400 VIANDBP
 + 1400 VIANDBC + 1800 VIANDOV  + 1700 LAINE
 -  300 SEMBD   -   300 SEMBT   -   200 SEMOG   -   700 SEMFV   -  3500 SEMBS
 -  150 TMT     - 10000 SEMPQ   -   120 SEMPDT  -   250 PMI     -   200 AUTCMI
 -  250 SEMVT   -   150 SEMFN   -   200 SEMEN   -    25 EAU1    -    25 EAU2
 -  118 AMMON   -   110 SP45    -   300 POTASS  - 3000 SALAIR1 - 3000 PMHOMM1
 - 3000 PMFEMM1 - 3000 SALAIR2 - 3000 PMHOMM2 - 3000 PMFEMM2 - 3000 SALAIR3
 - 3000 PMHOMM3 - 3000 PMFEMM3 - 3000 SALAIR4 - 3000 PMHOMM4 - 3000 PMFEMM4
 - 3000 SALAIR5 - 3000 PMHOMM5 - 3000 PMFEMM5 - 7000 TRACTN  - 17000 MOISS
 - 7000 MECHFN3 - 7000 MECHFV1 - 7000 MECHFV2 - 7000 MECHFV3 - 7000 MECHFV4
 - 7000 MECHFV5 - 12000 PRESS3 - 1000 TRANSPT - 8000 BSTRAIT -  150 CONCTR
 - 1000 DESHERB -    80 CREDIN -   150 CREDNIN
!
 SUBJECT TO
!
!*****************************************************************************
!
!  Agregation des Superficies des Céréales
!
!*****************************************************************************
!
 SUPBD)    SUPBD    - SUPBDH   - SUPBDM   - SUPBDT                          = 0
 SUPBT)    SUPBT    - SUPBTH   - SUPBTM   - SUPBTT                          = 0
 SUPOG)    SUPOG    - SUPOGH   - SUPOGM   - SUPOGT                          = 0
!
!*****************************************************************************
!
!  Superficies Céréales Technologie Moderne
!
!*****************************************************************************
!
 SUPBDH)   SUPBDH   - BDIH     - BD/LGIH  - BD/BSIH  - BD1H     - BD/LG1H
         - BD/JT1H  - BD/JP1H  - BD2H     - BD/LG2H  - BD/JT2H  - BD/JP2H
         - BD3H     - BD/LG3H  - BD/JT3H  - BD/JP3H                         = 0
 SUPBTH)   SUPBTH   - BTIH     - BT/LGIH  - BT/BSIH  - BT1H     - BT/LG1H
         - BT/JT1H  - BT/JP1H  - BT2H     - BT/LG2H  - BT/JT2H  - BT/JP2H   = 0
 SUPOGH)   SUPOGH   - OG1H     - OG/LG1H  - OG/JT1H  - OG/JP1H  - OG2H
         - OG/LG2H  - OG/JT2H  - OG/JP2H  - OG3H     - OG/LG3H  - OG/JT3H
         - OG/JF3H                                                           = 0
!
```

```
!*****************************************************************************
!
!  Superficies Céréales Technologie Moyenne
!
!*****************************************************************************
!
 SUPBDM)   SUPBDM   - BDIM     - BD/LGIM  - BD/BSIM  - BD1M     - BD/LG1M
         - BD/JT1M  - BD/JP1M  - BD2M     - BD/LG2M  - BD/JT2M  - BD/JP2M
         - BD3M     - BD/LG3M  - BD/JT3M  - BD/JP3M                          = 0
 SUPBTM)   SUPBTM   - BTIM     - BT/LGIM  - BT/BSIM  - BT1M     - BT/LG1M
         - BT/JT1M  - BT/JP1M  - BT2M     - BT/LG2M  - BT/JT2M  - BT/JP2M   = 0
 SUPOGM)   SUPOGM   - OG1M     - OG/LG1M  - OG/JT1M  - OG/JP1M  - OG2M
         - OG/LG2M  - OG/JT2M  - OG/JP2M  - OG3M     - OG/LG3M  - OG/JT3M
         - OG/JP3M                                                          = 0
!
!*****************************************************************************
!
!  Superficies Céréales Technologie Traditionnelle
!
!*****************************************************************************
!
 SUPBDT)   SUPBDT   - BDIT     - BD/LGIT  - BD/BSIT  - BD1T     - BD/LG1T
         - BD/JT1T  - BD/JP1T  - BD2T     - BD/LG2T  - BD/JT2T  - BD/JP2T
         - BD3T     - BD/LG3T  - BD/JT3T  - BD/JP3T                          = 0
 SUPBTT)   SUPBTT   - BTIT     - BT/LGIT  - BT/BSIT  - BT1T     - BT/LG1T
         - BT/JT1T  - BT/JP1T  - BT2T     - BT/LG2T  - BT/JT2T  - BT/JP2T
                                                                             = 0
 SUPOGT)   SUPOGT   - OG1T     - OG/LG1T  - OG/JT1T  - OG/JP1T  - OG2T
         - OG/LG2T  - OG/JT2T  - OG/JP2T  - OG3T     - OG/LG3T  - OG/JT3T
         - OG/JP3T                                                          = 0
!
!*****************************************************************************
!
!  Autres Superficies
!
!*****************************************************************************
!
SUPAU)     SUPAU     - AU/LG2   -  AU/JT2  - AU/LG3   - AU/JT3               = 0
SUPFV)     SUPFV     - FVI      -  FV/BSI  - FV1                             = 0
SUPBS)     SUPBS     - BSI                                                   = 0
SUPTM)     SUPTM     - TMI                                                   = 0
SUPPQ)     SUPPQ     - PQI                                                   = 0
SUPPDT)    SUPPDT    - PDTI     - PDTASI                                     = 0
SUPPM)     SUPPM     - PMI                                                   = 0
SUPACM)    SUPACM    - AUTCMI                                                = 0
SUPVRT)    SUPFVT    - FVVAI    - FVA/BSI  - FVOGI    - FVSGI    - BRGI
                     - LZI      - FVVA1    - FVOG1    - FVSG1    - FVVA2
                     - FVOG2    - FVSG2    - FVVA3    - FVOG3    - FVSG3      = 0
SUPFN)     SUPFN     - FNVAI    - FNVA1    - FNVA2    - FNVA3                 = 0
SUPEN)     SUPEN     - ENMSI    - ENSGI    - ENVAI    - ENVA1    - ENVA2
                     - ENVA3                                                 = 0
SUPJT)     SUPJT     - JT1      - JT2      - JT3                            = 0
SUPPAT)    SUPPAT    - JP1      - JP2      - JP3                            = 0
```

```
!*****************************************************************************
!
!  Contraintes Terre (ha)
!
!*****************************************************************************
!
 IRRIG1)   BDIH     + BD/LGIH  + BD/BSIH  + BTIH     + BT/LGIH  + BT/BSIH
         + BDIM     + BD/LGIM  + BD/BSIM  + BTIM     + BT/LGIM  + BT/BSIM
         + BDIT     + BD/LGIT  + BD/BSIT  + BTIT     + BT/LGIT  + BT/BSIT
         + FVI      + FV/BSI   + BSI      + CULTMAR  + FVVAI    + FVA/BSI
         + FVOGI    + FVSGI    + BRGI     + LZI      + FNVAI    + ENMSI
         + ENSGI    + ENVAI    + IRRSEC                         <=        23000
!
 IRRIG2)   PDTASI                                                <=         2500
!
 TERREPO)  BD1H     + BD/LG1H  + BD/JT1H  + BD/JP1H  + BT1H     + BT/LG1H
         + BT/JT1H  + BT/JP1H  + OG1H     + OG/LG1H  + OG/JT1H  + OG/JP1H
         + BD1M     + BD/LG1M  + BD/JT1M  + BD/JP1M  + BT1M     + BT/LG1M
         + BT/JT1M  + BT/JP1M  + OG1M     + OG/LG1M  + OG/JT1M  + OG/JP1M
         + BD1T     + BD/LG1T  + BD/JT1T  + BD/JP1T  + BT1T     + BT/LG1T
         + BT/JT1T  + BT/JP1T  + OG1T     + OG/LG1T  + OG/JT1T  + OG/JP1T
         + FV1      + FVVA1    + FVOG1    + FVSG1    + FNVA1    + ENVA1
         + JT1      + JP1                            - IRRSEC  <=       115000
!
 TERREPM)  BD2H     + BD/LG2H  + BD/JT2H  + BD/JP2H  + BT2H     + BT/LG2H
         + BT/JT2H  + BT/JP2H  + OG2H     + OG/LG2H  + OG/JT2H  + OG/JP2H
         + BD2M     + BD/LG2M  + BD/JT2M  + BD/JP2M  + BT2M     + BT/LG2M
         + BT/JT2M  + BT/JP2M  + OG2M     + OG/LG2M  + OG/JT2M  + OG/JP2M
         + BD2T     + BD/LG2T  + BD/JT2T  + BD/JP2T  + BT2T     + BT/LG2T
         + BT/JT2T  + BT/JP2T  + OG2T     + OG/LG2T  + OG/JT2T  + OG/JP2T
         + AU/LG2   + AU/JT2   + FVVA2    + FVOG2    + FVSG2    + FNVA2
         + ENVA2    + JT2      + JP2                            <=       604300
!
 TERREPF)  BD3H     + BD/LG3H  + BD/JT3H  + BD/JP3H  + OG3H     + OG/LG3H
         + OG/JT3H  + OG/JP3H  + BD3M     + BD/LG3M  + BD/JT3M  + BD/JP3M
         + OG3M     + OG/LG3M  + OG/JT3M  + OG/JP3M  + BD3T     + BD/LG3T
         + BD/JT3T  + BD/JP3T  + OG3T     + OG/LG3T  + OG/JT3T  + OG/JP3T
         + AU/LG3   + AU/JT3   + FVVA3    + FVOG3    + FVSG3    + FNVA3
         + ENVA3    + JT3      + JP3      + ARBOCULT            <=       363000
!
 PATURAGE) PATUR                                                 <=        96100
 JACH)     JP2                                                   >=        26450
!
 CULTMARI) CULTMAR                                               <=        16900
 LEGUME)   SUPFV                                                 =         57000
 AUTCERLS) SUPAU                                                 =         29000
 ARBOCULT) ARBOCULT                                              =         82900
!
!*****************************************************************************
!
!  Allocations Cultures Maraichères Fixé
!
!*****************************************************************************
!
```

```
 FIXTM)                TMI              - .20 CULTMAR              =              0
 FIXPQ)                PQI              - .27 CULTMAR              =              0
 FIXPDT)               PDTI             - .21 CULTMAR              =              0
 FIXPM)                PMI              - .07 CULTMAR              =              0
 FIXAUT)               AUTCMI           - .25 CULTMAR              =              0
!
!*******************************************************************************
!
!  Rotations des Cultures Céréalieres
!
!*******************************************************************************
!
 CERLEGMI) BD/LGIH  + BT/LGIH  + BD/LGIM  + BT/LGIM  + BD/LGIT  + BT/LGIT
         - FVVAI    - FNVAI    - ENVAI    - FVI      - BRGI                  = 0
!
 ASSOLBS1) BD/BSIH  + BT/BSIH  + BD/BSIM  + BT/BSIM  + BD/BSIT  + BT/BSIT
         + FVA/BSI  +  FV/BSI  - 2 BSI                                       = 0
!
 ASSOLBS2) BD/BSIH  + BT/BSIH  + BD/BSIM  + BT/BSIM  + BD/BSIT  + BT/BSIT
         - FVA/BSI  -  FV/BSI                                                = 0
!
 CERLEG1)  BD/LG1H  + BT/LG1H  + OG/LG1H  + BD/LG1M  + BT/LG1M  + OG/LG1M
         + BD/LG1T  + BT/LG1T  + OG/LG1T  - FV1      - FVVA1    - FNVA1
         - ENVA1                                                             = 0
!
 CERJCT1)  BD/JT1H  + BT/JT1H  + OG/JT1H  + BD/JT1M  + BT/JT1M  + OG/JT1M
         + BD/JT1T  + BT/JT1T  + OG/JT1T  - JT1                              = 0
!
 CERJCP1)  BD/JP1H  + BT/JP1H  + OG/JP1H  + BD/JP1M  + BT/JP1M  + OG/JP1M
         + BD/JP1T  + BT/JP1T  + OG/JP1T  - JP1                              = 0
!
 CERLEG2)  BD/LG2H  + BT/LG2H  + OG/LG2H  + BD/LG2M  + BT/LG2M  + OG/LG2M
         + BD/LG2T  + BT/LG2T  + OG/LG2T  + AU/LG2   - FVVA2    - FNVA2
         - ENVA2                                                             = 0
!
 CERJCT2)  BD/JT2H  + BT/JT2H  + OG/JT2H  + BD/JT2M  + BT/JT2M  + OG/JT2M
         + BD/JT2T  + BT/JT2T  + OG/JT2T  + AU/JT2   - JT2                   = 0
!
 CERJCP2)  BD/JP2H  + BT/JP2H  + OG/JP2H  + BD/JP2M  + BT/JP2M  + OG/JP2M
         + BD/JP2T  + BT/JP2T  + OG/JP2T  - JP2                              = 0
!
 CERLEG3)  BD/LG3H  + OG/LG3H  + BD/LG3M  + OG/LG3M  + BD/LG3T  + OG/LG3T
         + AU/LG3   - FVVA3    - FNVA3    - ENVA3                            = 0
!
 CERJCT3)  BD/JT3H  + OG/JT3H  + BD/JT3M  + OG/JT3M  + BD/JT3T  + OG/JT3T
         + AU/JT3   - JT3                                                    = 0
!
 CERJCP3)  BD/JP3H  + OG/JP3H  + BD/JP3M  + OG/JP3M  + BD/JP3T  + OG/JP3T
         - JP3                                                               = 0
!
```

```
!*****************************************************************************
!
!  Production de Céréales Aggregé
!
!*****************************************************************************
!
 PRODBD)   PRODBD   - PRDBDH   - PRDBDM   - PRDBDT                          = 0
 PRODBT)   PRODBT   - PRDBTH   - PRDBTM   - PRDBTT                          = 0
 PRODOG)   PRODOG   - PRDOGH   - PRDOGM   - PRDOGT                          = 0
!
!*****************************************************************************
!
!  Production Céréales Technologie Moderne
!
!*****************************************************************************
!
 PRDBDH)   PRDBDH  - 3.00 BDIH    - 3.30 BD/LGIH - 3.00 BD/BSIH - 1.45 BD1H
    - 1.60 BD/LG1H - 2.10 BD/JT1H - 1.45 BD/JP1H - 1.10 BD2H    - 1.20 BD/LG2H
    - 1.55 BD/JT2H - 1.10 BD/JP2H -  .65 BD3H    -  .70 BD/LG3H -  .90 BD/JT3H
    -  .65 BD/JP3H                                              =    0
!
 PRDBTH)   PRDBTH  - 3.40 BTIH    - 3.80 BT/LGIH - 3.40 BT/BSIH - 1.70 BT1H
    - 1.90 BT/LG1H - 2.55 BT/JT1H - 1.70 BT/JP1H - 1.10 BT2H    - 1.20 BT/LG2H
    - 1.65 BT/JT2H - 1.10 BT/JP2H                               =    0
!
 PRDOGH)   PRDOGH  - 1.40 OG1H    - 1.55 OG/LG1H - 1.80 OG/JT1H - 1.40 OG/JP1H
    - 1.20 OG2H    - 1.35 OG/LG2H - 1.50 OG/JT2H - 1.20 OG/JP2H - 1.05 OG3H
    - 1.15 OG/LG3H - 1.25 OG/JT3H - 1.05 OG/JP3H                =    0
!
!*****************************************************************************
!
!  Production Céréales Technologie Moyenne
!
!*****************************************************************************
!
 PRDBDM)   PRDBDM  - 2.84 BDIM    - 3.14 BD/LGIM - 2.34 BD/BSIM - 1.29 BD1M
    - 1.44 BD/LG1M - 1.94 BD/JT1M - 1.29 BD/JP1M - 1.01 BD2M    - 1.11 BD/LG2M
    - 1.46 BD/JT2M - 1.01 BD/JP2M - 0.61 BD3M    -  .66 BD/LG3M -  .86 BD/JT3M
    -  .61 BD/JP3M                                              =    0
!
 PRDBTM)   PRDBTM  - 3.20 BTIM    - 3.60 BT/LGIM - 3.20 BT/BSIM - 1.50 BT1M
    - 1.70 BT/LG1M - 2.35 BT/JT1M - 1.50 BT/JP1M - 1.01 BT2M    - 1.11 BT/LG2M
    - 1.56 BT/JT2M - 1.01 BT/JP2M                               =    0
!
 PRDOGM)   PRDOGM  - 1.27 OG1M    - 1.42 OG/LG1M - 1.67 OG/JT1M - 1.27 OG/JP1M
    - 1.12 OG2M    - 1.27 OG/LG2M - 1.42 OG/JT2M - 1.12 OG/JP2M - 1.00 OG3M
    - 1.10 OG/LG3M - 1.20 OG/JT3M - 1.00 OG/JP3M                =    0
!
!*****************************************************************************
!
!  Production Céréales Technologie Traditionnelle
!
!*****************************************************************************
!
```

```
PRDBDT)   PRDBDT  - 2.52 BDIT    - 2.82 BD/LGIT - 2.52 BD/BSIT - 0.97 BD1T
   - 1.12 BD/LG1T - 1.62 BD/JT1T - 0.97 BD/JP1T - 0.84 BD2T    - 0.94 BD/LG2T
   - 1.29 BD/JT2T -  .84 BD/JP2T - 0.53 BD3T    - 0.58 BD/LG3T - 0.78 BD/JT3T
   - 0.53 BD/JP3T                                              =    0
!
PRDBTT)   PRDBTT  - 2.84 BTIT    - 3.24 BT/LGIT - 2.84 BT/BSIT - 1.14 BT1T
   - 1.34 BT/LG1T - 1.99 BT/JT1T - 1.14 BT/JP1T - 0.84 BT2T    - 0.94 BT/LG2T
   - 1.39 BT/JT2T - 0.84 BT/JP2T                               =    0
!
PRDOGT)   PRDOGT  - 1.01 OG1T    - 1.16 OG/LG1T - 1.41 OG/JT1T - 1.01 OG/JP1T
   - 0.96 OG2T    - 1.11 OG/LG2T - 1.26 OG/JT2T - 0.96 OG/JP2T -  .90 OG3T
   - 1.00 OG/LG3T - 1.10 OG/JT3T - 0.90 OG/JP3T                =    0
!
!*****************************************************************************
!
!  Autres Production
!
!*****************************************************************************
!
PRODAU)   PRODAU  -  1.1 AU/LG2  -  1.4 AU/JT2  -  0.9 AU/LG3  -  1.1 AU/JT3
                                                              =    0
PRODFV)   PRODFV  - 1.25 FVI     - 1.25 FV/BSI  -  1.0 FV1    =    0
PRODBS)   PRODBS  - 47.3 BSI                                  =    0
PRODTM)   PRODTM  - 19.7 TMI                                  =    0
PRODPQ)   PRODPQ  - 11.8 PQI                                  =    0
PRODPDT)  PRODPDT - 10.7 PDTI    -  8.6 PDTASI                =    0
PRODPM)   PRODPM  -  7.1 PMI                                  =    0
PRODACM)  PRODACM - 15.0 AUTCMI                               =    0
!
!*****************************************************************************
!
!  Production de Fourrages en Vert
!
!*****************************************************************************
!
RFVVA1) PRDFVVA1 -   0 FVA/BSI  -   0 FVVAI   -   0 FVVA1   -   0 FVVA2
                 -   0 FVVA3                                              = 0
RFVVA2) PRDFVVA2 -   0 FVA/BSI  -   0 FVVAI   -   0 FVVA1   -   0 FVVA2
                 -   0 FVVA3                                              = 0
RFVVA3) PRDFVVA3 -  25 FVA/BSI  -  25 FVVAI   -  20 FVVA1   -  15 FVVA2
                 -   9 FVVA3                                              = 0
RFVVA4) PRDFVVA4 -   0 FVA/BSI  -   0 FVVAI   -   0 FVVA1   -   0 FVVA2
                 -   0 FVVA3                                              = 0
RFVVA5) PRDFVVA5 -   0 FVA/BSI -   0 FVVAI   -   0 FVVA1   -   0 FVVA2
                 -   0 FVVA3                                              = 0
!
RFVOG1) PRDFVOG1 -   0 FVOGI    -   0 FVOG1   -   0 FVOG2   -   0 FVOG3   = 0
RFVOG2) PRDFVOG2 -  27 FVOGI    -  22 FVOG1   -  17 FVOG2   -  11 FVOG3   = 0
RFVOG3) PRDFVOG3 -   0 FVOGI    -   0 FVOG1   -   0 FVOG2   -   0 FVOG3   = 0
RFVOG4) PRDFVOG4 -   0 FVOGI    -   0 FVOG1   -   0 FVOG2   -   0 FVOG3   = 0
RFVOG5) PRDFVOG5 -   0 FVOGI    -   0 FVOG1   -   0 FVOG2   -   0 FVOG3   = 0
!
```

```
 RFVSG1) PRDFVSG1 -   0 FVSGI    -   0 FVSG1   -   0 FVSG2   -   0 FVSG3   = 0
 RFVSG2) PRDFVSG2 -   0 FVSGI    -   0 FVSG1   -   0 FVSG2   -   0 FVSG3   = 0
 RFVSG3) PRDFVSG3 -   0 FVSGI    -   0 FVSG1   -   0 FVSG2   -   0 FVSG3   = 0
 RFVSG4) PRDFVSG4 -  25 FVSGI    -  15 FVSG1   -  10 FVSG2   -   5 FVSG3   = 0
 RFVSG5) PRDFVSG5 -  35 FVSGI    -  20 FVSG1   -  15 FVSG2   -  10 FVSG3   = 0
!
RFVBRG1) PRDBRG1  -   0 BRGI                                               = 0
RFVBRG2) PRDBRG2  -  30 BRGI                                               = 0
RFVBRG3) PRDBRG3  -  30 BRGI                                               = 0
RFVBRG4) PRDBRG4  -   0 BRGI                                               = 0
RFVBRG5) PRDBRG5  -   0 BRGI                                               = 0
!
 RFVLZ1) PRDLUZ1  -   9 LZI                                                = 0
 RFVLZ2) PRDLUZ2  -  12 LZI                                                = 0
 RFVLZ3) PRDLUZ3  -  12 LZI                                                = 0
 RFVLZ4) PRDLUZ4  -  12 LZI                                                = 0
 RFVLZ5) PRDLUZ5  -   9 LZI                                                = 0
!
 RFVPAT1) PRDPAT1 -  .8 JP1      -  .6 JP2     -  .5 JP3     -  .2 PATUR   = 0
 RFVPAT2) PRDPAT2 - 2.0 JP1      - 1.6 JP2     - 1.2 JP3     -  .6 PATUR   = 0
 RFVPAT3) PRDPAT3 - 2.0 JP1      - 1.6 JP2     - 1.2 JP3     -  .6 PATUR   = 0
 RFVPAT4) PRDPAT4 - 1.2 JP1      - 1.0 JP2     -  .8 JP3     -  .4 PATUR   = 0
 RFVPAT5) PRDPAT5 -  .0 JP1      -   0 JP2     -   0 JP3     -   0 PATUR   = 0
!
!*****************************************************************************
!
!  Production d'Ensilage
!
!*****************************************************************************
!
 RENVA1) PRDENVA1 -   0 ENVAI    -   0 ENVA1   -   0 ENVA2   -   0 ENVA3   = 0
 RENVA2) PRDENVA2 -   0 ENVAI    -   0 ENVA1   -   0 ENVA2   -   0 ENVA3   = 0
 RENVA3) PRDENVA3 -  25 ENVAI    -  20 ENVA1   -  15 ENVA2   -   9 ENVA3   = 0
 RENVA4) PRDENVA4 -   0 ENVAI    -   0 ENVA1   -   0 ENVA2   -   0 ENVA3   = 0
 RENVA5) PRDENVA5 -   0 ENVAI    -   0 ENVA1   -   0 ENVA2   -   0 ENVA3   = 0
!
 RENMS1) PRDENMS1 -   0 ENMSI                                              = 0
 RENMS2) PRDENMS2 -   0 ENMSI                                              = 0
 RENMS3) PRDENMS3 -   0 ENMSI                                              = 0
 RENMS4) PRDENMS4 -  50 ENMSI                                              = 0
 RENMS5) PRDENMS5 -   0 ENMSI                                              = 0
!
 RENSG1) PRDENSG1 -   0 ENSGI                                              = 0
 RENSG2) PRDENSG2 -   0 ENSGI                                              = 0
 RENSG3) PRDENSG3 -   0 ENSGI                                              = 0
 RENSG4) PRDENSG4 -  25 ENSGI                                              = 0
 RENSG5) PRDENSG5 -  35 ENSGI                                              = 0
!
!*****************************************************************************
!
!  Production de Foin
!
!*****************************************************************************
!
```

```
  RFNVA1) PRDFNVA1 -   0 FNVAI    -   0 FNVA1   -   0 FNVA2   -   0 FNVA3   = 0
  RFNVA2) PRDFNVA2 -   0 FNVAI    -   0 FNVA1   -   0 FNVA2   -   0 FNVA3   = 0
  RFNVA3) PRDFNVA3 - 6.3 FNVAI    - 5.0 FNVA1   - 4.1 FNVA2   - 2.7 FNVA3   = 0
  RFNVA4) PRDFNVA4 -   0 FNVAI    -   0 FNVA1   -   0 FNVA2   -   0 FNVA3   = 0
  RFNVA5) PRDFNVA5 -   0 FNVAI    -   0 FNVA1   -   0 FNVA2   -   0 FNVA3   = 0
!
!*****************************************************************************
!
!  Production de Paille
!
!*****************************************************************************
!
 RPAILL1) PRDPAL1                                                            = 0
 RPAILL2) PRDPAL2                                                            = 0
 RPAILL3) PRDPAL3                                                            = 0
 RPAILL4) PRDPAL4  - 1.02 PDPAL4H - 1.02 PDPAL4M  - 1.02 PDPAL4T             = 0
 RPAILL5) PRDPAL5                                                            = 0
!
 PRDPL4H) PDPAL4H  -    3 BDIH    -    3 BD/LGIH  -    3 BD/BSIH  - 2.3 BD1H
    - 2.3 BD/LG1H  -  2.3 BD/JT1H -  2.3 BD/JP1H  -  1.9 BD2H     - 1.9 BD/LG2H
    - 1.9 BD/JT2H  -  1.9 BD/JP2H -  1.5 BD3H     -  1.5 BD/LG3H  - 1.5 BD/JT3H
    - 1.5 BD/JP3H  -  2.6 BTIH    -  2.6 BT/LGIH  -  2.6 BT/BSIH  - 2.0 BT1H
    - 2.0 BT/LG1H  -  2.0 BT/JT1H -  2.0 BT/JP1H  -  1.7 BT2H     - 1.7 BT/LG2H
    - 1.7 BT/JT2H  -  1.7 BT/JP2H -  1.9 OG1H     -  1.9 OG/LG1H  - 1.9 OG/JT1H
    - 1.9 OG/JP1H  -  1.5 OG2H    -  1.5 OG/LG2H  -  1.5 OG/JT2H  - 1.5 OG/JP2H
    - 1.3 OG3H     -  1.3 OG/LG3H -  1.3 OG/JT3H  -  1.3 OG/JP3H <=   0
!
 PRDPL4M) PDPAL4M  -  2.8 BDIM    -  2.8 BD/LGIM  -  2.8 BD/BSIM -  2.1 BD1M
    - 2.1 BD/LG1M  -  2.1 BD/JT1M -  2.1 BD/JP1M  -  1.8 BD2M    -  1.8 BD/LG2M
    - 1.8 BD/JT2M  -  1.8 BD/JP2M -  1.4 BD3M     -  1.4 BD/LG3M -  1.4 BD/JT3M
    - 1.4 BD/JP3M  -  2.5 BTIM    -  2.5 BT/LGIM  -  2.5 BT/BSIM -  1.9 BT1M
    - 1.9 BT/LG1M  -  1.9 BT/JT1M -  1.9 BT/JP1M  -  1.5 BT2M    -  1.5 BT/LG2M
    - 1.5 BT/JT2M  -  1.5 BT/JP2M -  1.8 OG1M     -  1.8 OG/LG1M  - 1.8 OG/JT1M
    - 1.8 OG/JP1M  -  1.4 OG2M    -  1.4 OG/LG2M  -  1.4 OG/JT2M  - 1.4 OG/JP2M
    - 1.2 OG3M     -  1.2 OG/LG3M -  1.2 OG/JT3M  -  1.2 OG/JP3M  - 1.4 AU/LG2
    - 1.4 AU/JT2   -  1.2 AU/LG3  -  1.2 AU/JT3                   <=   0
!
 PRDPL4T) PDPAL4T  -  2.6 BDIT    -  2.6 BD/LGIT  -  2.6 BD/BSIT  - 2.0 BD1T
    - 2.0 BD/LG1T  -  2.0 BD/JT1T -  2.0 BD/JP1T  -  1.6 BD2T     - 1.6 BD/LG2T
    - 1.6 BD/JT2T  -  1.6 BD/JP2T -  1.3 BD3T     -  1.3 BD/LG3T  - 1.3 BD/JT3T
    - 1.3 BD/JP3T  -  2.3 BTIT    -  2.3 BT/LGIT  -  2.3 BT/BSIT  - 1.8 BT1T
    - 1.8 BT/LG1T  -  1.8 BT/JT1T -  1.8 BT/JP1T  -  1.4 BT2T     - 1.4 BT/LG2T
    - 1.4 BT/JT2T  -  1.4 BT/JP2T -  1.6 OG1T     -  1.6 OG/LG1T  - 1.6 OG/JT1T
    - 1.6 OG/JP1T  -  1.3 OG2T    -  1.3 OG/LG2T  -  1.3 OG/JT2T  - 1.3 OG/JP2T
    - 1.1 OG3T     -  1.1 OG/LG3T -  1.1 OG/JT3T  -  1.1 OG/JP3T <=   0
!
!*****************************************************************************
!
!  Transfert de Fourrage Vert
!
!*****************************************************************************
!
```

```
   FVVA1)   PRDFVVA1   +      0 TFVVA51   -   CFVVA1   -   TFVVA12      >= 0
   FVVA2)   PRDFVVA2   +      0 TFVVA12   -   CFVVA2   -   TFVVA23      >= 0
   FVVA3)   PRDFVVA3   +      0 TFVVA23   -   CFVVA3   -   TFVVA34      >= 0
   FVVA4)   PRDFVVA4   +      0 TFVVA34   -   CFVVA4   -   TFVVA45      >= 0
   FVVA5)   PRDFVVA5   +      0 TFVVA45   -   CFVVA5   -   TFVVA51      >= 0
!
   FVOG1)   PRDFVOG1   +      0 TFVOG51   -   CFVOG1   -   TFVOG12      >= 0
   FVOG2)   PRDFVOG2   +      0 TFVOG12   -   CFVOG2   -   TFVOG23      >= 0
   FVOG3)   PRDFVOG3   +      0 TFVOG23   -   CFVOG3   -   TFVOG34      >= 0
   FVOG4)   PRDFVOG4   +      0 TFVOG34   -   CFVOG4   -   TFVOG45      >= 0
   FVOG5)   PRDFVOG5   +      0 TFVOG45   -   CFVOG5   -   TFVOG51      >= 0
!
   FVSG1)   PRDFVSG1   +      0 TFVSG51   -   CFVSG1   -   TFVSG12      >= 0
   FVSG2)   PRDFVSG2   +      0 TFVSG12   -   CFVSG2   -   TFVSG23      >= 0
   FVSG3)   PRDFVSG3   +      0 TFVSG23   -   CFVSG3   -   TFVSG34      >= 0
   FVSG4)   PRDFVSG4   +      0 TFVSG34   -   CFVSG4   -   TFVSG45      >= 0
   FVSG5)   PRDFVSG5   +      0 TFVSG45   -   CFVSG5   -   TFVSG51      >= 0
!
   FVBRG1)  PRDBRG1    +      0 TBRG51    -   CFVBRG1  -   TBRG12       >= 0
   FVBRG2)  PRDBRG2    +      0 TBRG12    -   CFVBRG2  -   TBRG23       >= 0
   FVBRG3)  PRDBRG3    +      0 TBRG23    -   CFVBRG3  -   TBRG34       >= 0
   FVBRG4)  PRDBRG4    +      0 TBRG34    -   CFVBRG4  -   TBRG45       >= 0
   FVBRG5)  PRDBRG5    +      0 TBRG45    -   CFVBRG5  -   TBRG51       >= 0
!
   FVLZ1)   PRDLUZ1    +      0 TLZ51     -   CFVLZ1   -   TLZ12        >= 0
   FVLZ2)   PRDLUZ2    +      0 TLZ12     -   CFVLZ2   -   TLZ23        >= 0
   FVLZ3)   PRDLUZ3    +      0 TLZ23     -   CFVLZ3   -   TLZ34        >= 0
   FVLZ4)   PRDLUZ4    +      0 TLZ34     -   CFVLZ4   -   TLZ45        >= 0
   FVLZ5)   PRDLUZ5    +      0 TLZ45     -   CFVLZ5   -   TLZ51        >= 0
!
   FVPAT1)  PRDPAT1    +      0 TPAT51    -   CFVPAT1  -   TPAT12       >= 0
   FVPAT2)  PRDPAT2    +      0 TPAT12    -   CFVPAT2  -   TPAT23       >= 0
   FVPAT3)  PRDPAT3    +      0 TPAT23    -   CFVPAT3  -   TPAT34       >= 0
   FVPAT4)  PRDPAT4    +      0 TPAT34    -   CFVPAT4  -   TPAT45       >= 0
   FVPAT5)  PRDPAT5    +      0 TPAT45    -   CFVPAT5  -   TPAT51       >= 0
!
!*******************************************************************************
!
!  Transfert d'Ensilage
!
!*******************************************************************************
!
   ENVA1)   PRDENVA1   +   0.90 TENVA51    -   CENVA1   -   TENVA12      >= 0
   ENVA2)   PRDENVA2   +   0.90 TENVA12    -   CENVA2   -   TENVA23      >= 0
   ENVA3)   PRDENVA3   +   1.00 TENVA23    -   CENVA3   -   TENVA34      >= 0
   ENVA4)   PRDENVA4   +   0.90 TENVA34    -   CENVA4   -   TENVA45      >= 0
   ENVA5)   PRDENVA5   +   0.90 TENVA45    -   CENVA5   -   TENVA51      >= 0
!
   ENMS1)   PRDENMS1   +   0.90 TMS51      -   CENMS1   -   TMS12        >= 0
   ENMS2)   PRDENMS2   +   0.90 TMS12      -   CENMS2   -   TMS23        >= 0
   ENMS3)   PRDENMS3   +   0.90 TMS23      -   CENMS3   -   TMS34        >= 0
   ENMS4)   PRDENMS4   +   1.00 TMS34      -   CENMS4   -   TMS45        >= 0
   ENMS5)   PRDENMS5   +   0.90 TMS45      -   CENMS5   -   TMS51        >= 0
!
```

```
   ENSG1)   PRDENSG1    +   0.90 TSG51      -   CENSG1    -   TSG12          >= 0
   ENSG2)   PRDENSG2    +   0.90 TSG12      -   CENSG2    -   TSG23          >= 0
   ENSG3)   PRDENSG3    +   0.90 TSG23      -   CENSG3    -   TSG34          >= 0
   ENSG4)   PRDENSG4    +   1.00 TSG34      -   CENSG4    -   TSG45          >= 0
   ENSG5)   PRDENSG5    +   0.90 TSG45      -   CENSG5    -   TSG51          >= 0
!
!*****************************************************************************
!
!  Transfert de Foin et Paille
!
!*****************************************************************************
!
   FNVA1)   PRDFNVA1    +   0.97 TFNVA51    -   CFNVA1    -   TFNVA12
                                            -   FOIN1                        >= 0
   FNVA2)   PRDFNVA2    +   0.97 TFNVA12    -   CFNVA2    -   TFNVA23
                                            -   FOIN2                        >= 0
   FNVA3)   PRDFNVA3    +   1.00 TFNVA23    -   CFNVA3    -   TFNVA34        >= 0
   FNVA4)   PRDFNVA4    +   0.97 TFNVA34    -   CFNVA4    -   TFNVA45        >= 0
   FNVA5)   PRDFNVA5    +   0.97 TFNVA45    -   CFNVA5    -   TFNVA51
                                            -   FOIN5                        >= 0
!
   FNPAL1)  PRDPAL1     +    .97 TPAL51     -   CFNPAL1   -   TPAL12
                                            -   CLTPAL1   -   PAILLE1        >= 0
   FNPAL2)  PRDPAL2     +    .97 TPAL12     -   CFNPAL2   -   TPAL23
                                            -   CLTPAL2   -   PAILLE2        >= 0
   FNPAL3)  PRDPAL3     +    .97 TPAL23     -   CFNPAL3   -   TPAL34
                                            -   CLTPAL3                      >= 0
   FNPAL4)  PRDPAL4     +   1.00 TPAL34     -   CFNPAL4   -   TPAL45
                                            -   CLTPAL4                      >= 0
   FNPAL5)  PRDPAL5     +    .97 TPAL45     -   CFNPAL5   -   TPAL51
                                            -   CLTPAL5   -   PAILLE5        >= 0
!
!*****************************************************************************
!
!  Valeur Nutritive des Fourrages (par tonne de matière brute) et Besoins de
!  l'Elevage
!
!*****************************************************************************
!
 UF1)    180 CFVVA1  +  615 CFNVA1  +  170 CFVOG1  +  190 CFVSG1  +  200 CFVPAT1
     +   200 CENVA1  +  265 CENMS1  +  215 CENSG1  +  115 CFVBRG1 +  180 CFVLZ1
     +   395 CFNPAL1 -  420 BOVP    -  300 BOVC    -   60 OVIN    >=   0
!
 MAD1)    27 CFVVA1  +   74 CFNVA1  +   19 CFVOG1  +   15 CFVSG1  +   26 CFVPAT1
     +    21 CENVA1  +   24 CENMS1  +   16 CENSG1  +   15 CFVBRG1 +   30 CFVLZ1
     +    39 CFNPAL1 -   35 BOVP    -   25 BOVC    -    5 OVIN    >=   0
!
 MS1)    280 CFVVA1  +  855 CFNVA1  +  210 CFVOG1  +  235 CFVSG1  +  270 CFVPAT1
     +   300 CENVA1  +  290 CENMS1  +  255 CENSG1  +  160 CFVBRG1 +  235 CFVLZ1
     +   865 CFNPAL1 -  685 BOVP    -  490 BOVC    -  100 OVIN    >=   0
!
 FOIN1)      CFNVA1  +      CFNPAL1 - .122 BOVP    - .122 BOVC    >=   0
!
 LITIER1)    CLTPAL1 -  .01 OVIN    -  .05 BOVP    -  .05 BOVC    >=   0
!
```

```
 UF2)   180 CFVVA2  +  615 CFNVA2  +  170 CFVOG2  +  190 CFVSG2  +  200 CFVPAT2
     +  200 CENVA2  +  265 CENMS2  +  215 CENSG2  +  115 CFVBRG2 +  180 CFVLZ2
     +  395 CFNPAL2 -  625 BOVP    -  445 BOVC    -   90 OVIN    >=   0
!
 MAD2)   27 CFVVA2  +   74 CFNVA2  +   19 CFVOG2  +   15 CFVSG2  +   26 CFVPAT2
     +   21 CENVA2  +   24 CENMS2  +   16 CENSG2  +   15 CFVBRG2 +   30 CFVLZ2
     +   39 CFNPAL2 -   55 BOVP    -   40 BOVC    -    8 OVIN    >=   0
!
 MS2)   280 CFVVA2  +  855 CFNVA2  +  210 CFVOG2  +  235 CFVSG2  +  270 CFVPAT2
     +  300 CENVA2  +  290 CENMS2  +  255 CENSG2  +  160 CFVBRG2 +  235 CFVLZ2
     +  865 CFNPAL2 - 1025 BOVP    -  730 BOVC    -  145 OVIN    >=   0
!
 FOIN2)     CFNVA2  +      CFNPAL2 - .183 BOVP    - .183 BOVC    >=   0
!
 LITIER2)   CLTPAL2 -  .02 OVIN    -  .07 BOVP    -  .07 BOVC    >=   0
!
 UF3)   180 CFVVA3  +  615 CFNVA3  +  170 CFVOG3  +  190 CFVSG3  +  200 CFVPAT3
     +  200 CENVA3  +  265 CENMS3  +  215 CENSG3  +  115 CFVBRG3 +  180 CFVLZ3
     +  395 CFNPAL3 -  625 BOVP    -  445 BOVC    -   90 OVIN    >=   0
!
 MAD3)   27 CFVVA3  +   74 CFNVA3  +   19 CFVOG3  +   15 CFVSG3  +   26 CFVPAT3
     +   21 CENVA3  +   24 CENMS3  +   16 CENSG3  +   15 CFVBRG3 +   30 CFVLZ3
     +   39 CFNPAL3 -   55 BOVP    -   40 BOVC    -    8 OVIN    >=   0
!
 MS3)   280 CFVVA3  +  855 CFNVA3  +  210 CFVOG3  +  235 CFVSG3  +  270 CFVPAT3
     +  300 CENVA3  +  290 CENMS3  +  255 CENSG3  +  160 CFVBRG3 +  235 CFVLZ3
     +  865 CFNPAL3 - 1025 BOVP    -  730 BOVC    -  145 OVIN    >=   0
!
 FOIN3)     CFNVA3  +      CFNPAL3 - .183 BOVP    - .183 BOVC    >=   0
!
 LITIER3)   CLTPAL3 -  .02 OVIN    -  .07 BOVP    -  .07 BOVC    >=   0
!
 UF4)   180 CFVVA4  +  615 CFNVA4  +  170 CFVOG4  +  190 CFVSG4  +  200 CFVPAT4
     +  200 CENVA4  +  265 CENMS4  +  215 CENSG4  +  115 CFVBRG4 +  180 CFVLZ4
     +  395 CFNPAL4 -  420 BOVP    -  300 BOVC    -   60 OVIN    >=   0
!
 MAD4)   27 CFVVA4  +   74 CFNVA4  +   19 CFVOG4  +   15 CFVSG4  +   26 CFVPAT4
     +   21 CENVA4  +   24 CENMS4  +   16 CENSG4  +   15 CFVBRG4 +   30 CFVLZ4
     +   39 CFNPAL4 -   35 BOVP    -   25 BOVC    -    5 OVIN    >=   0
!
 MS4)   280 CFVVA4  +  855 CFNVA4  +  210 CFVOG4  +  235 CFVSG4  +  270 CFVPAT4
     +  300 CENVA4  +  290 CENMS4  +  255 CENSG4  +  160 CFVBRG4 +  235 CFVLZ4
     +  865 CFNPAL4 -  685 BOVP    -  490 BOVC    -  100 OVIN    >=   0
!
 FOIN4)     CFNVA4  +      CFNPAL4 - .122 BOVP    - .122 BOVC    >=   0
!
 LITIER4)   CLTPAL4 -  .01 OVIN    -  .05 BOVP    -  .05 BOVC    >=   0
!
 UF5)   180 CFVVA5  +  615 CFNVA5  +  170 CFVOG5  +  190 CFVSG5  +  200 CFVPAT5
     +  200 CENVA5  +  265 CENMS5  +  215 CENSG5  +  115 CFVBRG5 +  180 CFVLZ5
     +  395 CFNPAL5 -  420 BOVP    -  300 BOVC    -   60 OVIN    >=   0
!
 MAD5)   27 CFVVA5  +   74 CFNVA5  +   19 CFVOG5  +   15 CFVSG5  +   26 CFVPAT5
     +   21 CENVA5  +   24 CENMS5  +   16 CENSG5  +   15 CFVBRG5 +   30 CFVLZ5
     +   39 CFNPAL5 -   35 BOVP    -   25 BOVC    -    5 OVIN    >=   0
!
```

```
 MS5)   280 CFVVA5  +  855 CFNVA5  +  210 CFVOG5  +  235 CFVSG5  +  270 CFVPAT5
     +  300 CENVA5  +  290 CENMS5  +  255 CENSG5  +  160 CFVBRG5 +  235 CFVLZ5
     +  865 CFNPAL5 -  685 BOVP    -  490 BOVC    -  100 OVIN    >=   0
!
 FOIN5)     CFNVA5  +      CFNPAL5 - .122 BOVP    - .122 BOVC    >=   0
!
 LITIER5)   CLTPAL5 -  .01 OVIN    -  .05 BOVP    -  .05 BOVC    >=   0
!
!*****************************************************************************
!
!  Besoins des Animaux en Concentre/Unite Femelle (tn/Annee)
!
!*****************************************************************************
!
 Conctr)   1 BOVP   +   .7 BOVC    +  0.0 OVIN    -      CONCTR  <=   0
!
!*****************************************************************************
!
!  Stocks animaux dans le court terme (Unites Femelles)
!
!*****************************************************************************
!
  BOVPMAX)                 BOVP   <=        0
  BOVCMAX)                 BOVC   <=   198900
  OVINMAX)                 OVIN   <=  1199110
!
!*****************************************************************************
!
!  Productions Animales: Lait et Viande  (Tonne/Unite Femelle)
!
!*****************************************************************************
!
   LAITBP)             LAITBP      - 1.75 BOVP   <=        0
   LAITBC)             LAITBC      - 1.25 BOVC   <=        0
   WOOLOV)             LAINE       - .003 OVIN   <=        0
   VIANDBP)            VIANDBP     -  .24 BOVP   <=        0
   VIANDBC)            VIANDBC     - .189 BOVC   <=        0
   VIANDOV)            VIANDOV     - .031 OVIN   <=        0
!
!*****************************************************************************
!
!  Semences (Tonne/ha)
!
!*****************************************************************************
!
 SEMBD)   SEMBD   -   SEMBDH    -   SEMBDM    -   SEMBDT                  = 0
 SEMBT)   SEMBT   -   SEMBTH    -   SEMBTM    -   SEMBTT                  = 0
 SEMOG)   SEMOG   -   SEMOGH    -   SEMOGM    -   SEMOGT                  = 0
!
!*****************************************************************************
!
!     Semences Céréales Technologie Moderne (Tonne/ha)
!
!*****************************************************************************
!
```

```
 SEMBDH)   SEMBDH  - .125 BDIH    - .125 BD/LGIH - .125 BD/BSIH - .120 BD1H
    - .120 BD/LG1H - .120 BD/JT1H - .120 BD/JP1H - .115 BD2H    - .115 BD/LG2H
    - .115 BD/JT2H - .115 BD/JP2H - .110 BD3H    - .110 BD/LG3H - .110 BD/JT3H
    - .110 BD/JP3H                                              =    0
!
 SEMBTH)   SEMBTH  - .125 BTIH    - .125 BT/LGIH - .125 BT/BSIH - .120 BT1H
    - .120 BT/LG1H - .120 BT/JT1H - .120 BT/JP1H - .115 BT2H    - .115 BT/LG2H
    - .115 BT/JT2H - .115 BT/JP2H                               =    0
!
 SEMOGH)   SEMOGH  - .120 OG1H    - .120 OG/LG1H - .120 OG/JT1H - .120 OG/JP1H
    - .115 OG2H    - .115 OG/LG2H - .115 OG/JT2H - .115 OG/JP2H - .100 OG3H
    - .100 OG/LG3H - .100 OG/JT3H - .100 OG/JP3H                =    0
!
!*****************************************************************************
!
!     Semences Céréales Technologie Moyenne (Tonne/ha)
!
!*****************************************************************************
!
 SEMBDM)   SEMBDM  - .125 BDIM    - .125 BD/LGIM - .125 BD/BSIM - .120 BD1M
    - .120 BD/LG1M - .120 BD/JT1M - .120 BD/JP1M - .115 BD2M    - .115 BD/LG2M
    - .115 BD/JT2M - .115 BD/JP2M - .110 BD3M    - .110 BD/LG3M - .110 BD/JT3M
    - .110 BD/JP3M                                              =    0
!
 SEMBTM)   SEMBTM  - .125 BTIM    - .125 BT/LGIM - .125 BT/BSIM - .120 BT1M
    - .120 BT/LG1M - .120 BT/JT1M - .120 BT/JP1M - .115 BT2M    - .115 BT/LG2M
    - .115 BT/JT2M - .115 BT/JP2M                               =    0
!
 SEMOGM)   SEMOGM  - .120 OG1M    - .120 OG/LG1M - .120 OG/JT1M - .120 OG/JP1M
    - .115 OG2M    - .115 OG/LG2M - .115 OG/JT2M - .115 OG/JP2M - .100 OG3M
    - .100 OG/LG3M - .100 OG/JT3M - .100 OG/JP3M                =    0
!
!*****************************************************************************
!
!     Semences Céréales Technologie Traditionnelle (Tonne/ha)
!
!*****************************************************************************
!
 SEMBDT)   SEMBDT  - .125 BDIT    - .125 BD/LGIT - .125 BD/BSIT - .120 BD1T
    - .120 BD/LG1T - .120 BD/JT1T - .120 BD/JP1T - .115 BD2T    - .115 BD/LG2T
    - .115 BD/JT2T - .115 BD/JP2T - .110 BD3T    - .110 BD/LG3T - .110 BD/JT3T
    - .110 BD/JP3T                                              =    0
!
 SEMBTT)   SEMBTT  - .125 BTIT    - .125 BT/LGIT - .125 BT/BSIT - .120 BT1T
    - .120 BT/LG1T - .120 BT/JT1T - .120 BT/JP1T - .115 BT2T    - .115 BT/LG2T
    - .115 BT/JT2T - .115 BT/JP2T                               =    0
!
 SEMOGT)   SEMOGT  - .120 OG1T    - .120 OG/LG1T - .120 OG/JT1T - .120 OG/JP1T
    - .115 OG2T    - .115 OG/LG2T - .115 OG/JT2T - .115 OG/JP2T - .100 OG3T
    - .100 OG/LG3T - .100 OG/JT3T - .100 OG/JP3T                =    0
!
```

```
!*************************************************************************
!
!  Autres Semences (Tonne/ha)
!
!*************************************************************************
!
 SEMAU)     SEMAU    - .115 AU/LG2  - .115 AU/JT2  - .100 AU/LG3  - .100 AU/JT3
                                                                          = 0
 SEMCFV)    SEMFV    - .100 FVI     - .100 FV/BSI  - .095 FV1              = 0
 SEMCBS)    SEMBS    - .015 BSI                                            = 0
 SEMCPQ)    SEMPQ    - .002 PQI                                            = 0
 SEMCPT)    SEMPDT   -  2.5 PDTI    -  2.5 PDTASI                          = 0
 SEMVT)     SEMVT    - .110 FVVAI   - .110 FVA/BSI - .105 FVVA1   - .105 FVVA2
                     - .100 FVVA3   - .110 FVOGI   - .050 FVSGI   - .105 FVOG1
                     - .045 FVSG1   - .105 FVOG2   - .045 FVSG2   - .100 FVOG3
                     - .040 FVSG3   - .040 BRGI    - .025 LZI                = 0
 SEMCEN)    SEMEN    - .035 ENMSI   - .050 ENSGI   - .110 ENVAI   - .105 ENVA1
                     - .105 ENVA2   - .100 ENVA3                           = 0
 SEMFN)     SEMFN    - .110 FNVAI   - .105 FNVA1   - .105 FNVA2   - .100 FNVA3
                                                                          = 0
!
!*************************************************************************
!
!  Main d'Oeuvre Agricole, Sommaire
!
!*************************************************************************
!
 ARBCULT1)            165 ARBICULT                - 1000 TRVARB1 <=   0
 ARBCULT2)            250 ARBICULT                - 1000 TRVARB2 <=   0
 ARBCULT3)            250 ARBICULT                - 1000 TRVARB3 <=   0
 ARBCULT4)            165 ARBICULT                - 1000 TRVARB4 <=   0
 ARBCULT5)            165 ARBICULT                - 1000 TRVARB5 <=   0
!
 SALAR) SALAIR1  +      SALAIR2  +      SALAIR3  +      SALAIR4  +      SALAIR5
                                                               <= 2442
!
 TRAV1) PREP1    +      EPAND1   +      SEMIS1   +      DESHER1  +      MOISS1
 +      TRAVFUR1 +      TRAVFN1  +      TRAVFV1  +      TRAVEN1  +      TRVARB1
 + .030 BOVP     + .025 BOVC     + .002 OVIN     - 5.70 FMHOMM1  - 5.70 FMFEMM1
 - 5.70 PMHOMM1  - 5.70 PMFEMM1  - 5.70 SALAIR1 <=    0
!
 TRAV2) PREP2    +      EPAND2   +      SEMIS2   +      DESHER2  +      MOISS2
 +      TRAVFUR2 +      TRAVFN2  +      TRAVFV2  +      TRAVEN2  +      TRVARB2
 + .045 BOVP     + .040 BOVC     + .003 OVIN     - 5.70 FMHOMM2  - 5.70 FMFEMM2
 - 5.70 PMHOMM2  - 5.70 PMFEMM2  - 5.70 SALAIR2 <=    0
!
 TRAV3) PREP3    +      EPAND3   +      SEMIS3   +      DESHER3  +      MOISS3
 +      TRAVFUR3 +      TRAVFN3  +      TRAVFV3  +      TRAVEN3  +      TRVARB3
 + .045 BOVP     + .040 BOVC     + .003 OVIN     - 5.70 FMHOMM3  - 5.70 FMFEMM3
 - 5.70 PMHOMM3  - 5.70 PMFEMM3  - 5.70 SALAIR3 <=    0
!
```

```
 TRAV4) PREP4     +       EPAND4    +       SEMIS4    +       DESHER4   +       MOISS4
 +      TRAVFUR4  +       TRAVFN4   +       TRAVFV4   +       TRAVEN4   +       TRVARB4
 + .030 BOVP      + .025  BOVC      + .002  OVIN      - 5.70  FMHOMM4   - 5.70  FMFEMM4
 - 5.70 PMHOMM4   - 5.70  PMFEMM4   - 5.70  SALAIR4  <=     0
!
 TRAV5) PREP5     +       EPAND5    +       SEMIS5    +       DESHER5   +       MOISS5
 +      TRAVFUR5  +       TRAVFN5   +       TRAVFV5   +       TRAVEN5   +       TRVARB5
 + .030 BOVP      + .025  BOVC      + .002  OVIN      - 5.70  FMHOMM5   - 5.70  FMFEMM5
 - 5.70 PMHOMM5   - 5.70  PMFEMM5   - 5.70  SALAIR5  <=     0
!
!*****************************************************************************
!
!  Disponibilité du Travail (Effectifs x jours/periodes): Hommes=240 jours/an,
!  Femmes=230 jours/an; Salaire Permanent--Hommes=320 jours/an, Femmes=270
!  jours/an (Enquête Agricole de Base 1986).
!
!*****************************************************************************
!
 FMHOMME)  FMHOMME                                          <=    37950
 FMFEMME)  FMFEMME                                          <=    25590
 PMHOMME)  PMHOMME                                           =    12800
 PMFEMME)  PMFEMME                                           =      450
!
 FMHOMM1)  FMHOMM1                 - .040 FMHOMME           <=    0
 FMHOMM2)  FMHOMM2                 - .060 FMHOMME           <=    0
 FMHOMM3)  FMHOMM3                 - .060 FMHOMME           <=    0
 FMHOMM4)  FMHOMM4                 - .040 FMHOMME           <=    0
 FMHOMM5)  FMHOMM5                 - .040 FMHOMME           <=    0
!
 FMFEMM1)  FMFEMM1                 - .038 FMFEMME           <=    0
 FMFEMM2)  FMFEMM2                 - .058 FMFEMME           <=    0
 FMFEMM3)  FMFEMM3                 - .058 FMFEMME           <=    0
 FMFEMM4)  FMFEMM4                 - .038 FMFEMME           <=    0
 FMFEMM5)  FMFEMM5                 - .038 FMFEMME           <=    0
!
 PMHOMM1)  PMHOMM1                 - .053 PMHOMME            =    0
 PMHOMM2)  PMHOMM2                 - .080 PMHOMME            =    0
 PMHOMM3)  PMHOMM3                 - .080 PMHOMME            =    0
 PMHOMM4)  PMHOMM4                 - .054 PMHOMME            =    0
 PMHOMM5)  PMHOMM5                 - .053 PMHOMME            =    0
!
 PMFEMM1)  PMFEMM1                 - .045 PMFEMME            =    0
 PMFEMM2)  PMFEMM2                 - .067 PMFEMME            =    0
 PMFEMM3)  PMFEMM3                 - .068 PMFEMME            =    0
 PMFEMM4)  PMFEMM4                 - .045 PMFEMME            =    0
 PMFEMM5)  PMFEMM5                 - .045 PMFEMME            =    0
!
!*****************************************************************************
!
!  Préparation du Sol, Main d'Oeuvre Agricole (heures/ha)
!
!*****************************************************************************
!
```

```
MOPREP1)
      3.5 BDIH     +  3.5 BD/LGIH +  3.5 BD/BSIH +  3.5 BD1H     +  3.5 BD/LG1H
    + 3.5 BD/JT1H + 3.5 BD/JP1H +  3.1 BD2H     +  3.1 BD/LG2H +  3.1 BD/JT2H
    + 3.1 BD/JP2H + 2.8 BD3H     +  2.8 BD/LG3H +  2.8 BD/JT3H +  2.8 BD/JP3H
    + 3.5 BTIH     +  3.5 BT/LGIH +  3.5 BT/BSIH +  3.5 BT1H     +  3.5 BT/LG1H
    + 3.5 BT/JT1H + 3.5 BT/JP1H +  3.1 BT2H     +  3.1 BT/LG2H +  3.1 BT/JT2H
    + 3.1 BT/JP2H +    0 OG1H     +    0 OG/LG1H +    0 OG/JT1H +    0 OG/JP1H
    +    0 OG2H     +    0 OG/LG2H +    0 OG/JT2H +    0 OG/JP2H +    0 OG3H
    +    0 OG/LG3H +    0 OG/JT3H +    0 OG/JP3H
!
    + 3.5 BDIM     +  3.5 BD/LGIM +  3.5 BD/BSIM +  3.5 BD1M     +  3.5 BD/LG1M
    + 3.5 BD/JT1M + 3.5 BD/JP1M +  3.1 BD2M     +  3.1 BD/LG2M +  3.1 BD/JT2M
    + 3.1 BD/JP2M + 2.8 BD3M     +  2.8 BD/LG3M +  2.8 BD/JT3M +  2.8 BD/JP3M
    + 3.5 BTIM     +  3.5 BT/LGIM +  3.5 BT/BSIM +  3.5 BT1M     +  3.5 BT/LG1M
    + 3.5 BT/JT1M + 3.5 BT/JP1M +  3.1 BT2M     +  3.1 BT/LG2M +  3.1 BT/JT2M
    + 3.1 BT/JP2M +    0 OG1M     +    0 OG/LG1M +    0 OG/JT1M +    0 OG/JP1M
    +    0 OG2M     +    0 OG/LG2M +    0 OG/JT2M +    0 OG/JP2M +    0 OG3M
    +    0 OG/LG3M +    0 OG/JT3M +    0 OG/JP3M
!
    + 3.5 BDIT     +  3.5 BD/LGIT +  3.5 BD/BSIT +  3.5 BD1T     +  3.5 BD/LG1T
    + 3.5 BD/JT1T + 3.5 BD/JP1T +  3.1 BD2T     +  3.1 BD/LG2T +  3.1 BD/JT2T
    + 3.1 BD/JP2T + 2.8 BD3T     +  2.8 BD/LG3T +  2.8 BD/JT3T +  2.8 BD/JP3T
    + 3.5 BTIT     +  3.5 BT/LGIT +  3.5 BT/BSIT +  3.5 BT1T     +  3.5 BT/LG1T
    + 3.5 BT/JT1T + 3.5 BT/JP1T +  3.1 BT2T     +  3.1 BT/LG2T +  3.1 BT/JT2T
    + 3.1 BT/JP2T +    0 OG1T     +    0 OG/LG1T +    0 OG/JT1T +    0 OG/JP1T
    +    0 OG2T     +    0 OG/LG2T +    0 OG/JT2T +    0 OG/JP2T +    0 OG3T
    +    0 OG/LG3T +    0 OG/JT3T +    0 OG/JP3T
!
    + 3.1 AU/LG2   +  3.1 AU/JT2   +  2.8 AU/LG3   +  2.8 AU/JT3   +  6.0 BSI
    + 3.5 FVI      +  3.5 FV/BSI   +  3.5 FV1      +    0 TMI      +    0 PQI
    +    0 PDTI    +    0 PDTASI  +    0 PMI      +    0 FVVAI    +    0 FVA/BSI
    +    0 FVVA1   +    0 FVVA2   +    0 FVVA3    +    0 FNVAI    +    0 FNVA1
    +    0 FNVA2   +    0 FNVA3   +    0 FVOGI    +    0 FVOG1    +    0 FVOG2
    +    0 FVOG3   +    0 FVSGI   +    0 FVSG1    +    0 FVSG2    +    0 FVSG3
    +    0 ENVAI   +    0 ENVA1   +    0 ENVA2    +    0 ENVA3    +    0 BRGI
    +    0 LZI     - 1000 PREP1    =    0
!
MOPREP2)
         0 BSI      +    0 FVI      +    0 FV/BSI   +    0 FV1      +  4.7 TMI
    +  7.0 PQI      +  4.7 PDTI     +    0 PDTASI   +  4.7 PMI      +  4.7 AUTCMI
    +    0 FVVAI    +    0 FVA/BSI  +    0 FVVA1    +    0 FVVA2    +    0 FVVA3
    +    0 FNVAI    +    0 FNVA1    +    0 FNVA2    +    0 FNVA3    +    0 FVOGI
    +    0 FVOG1    +    0 FVOG2    +    0 FVOG3    +    0 FVSGI    +    0 FVSG1
    +    0 FVSG2    +    0 FVSG3    +    0 ENVAI    +    0 ENVA1    +    0 ENVA2
    +    0 ENVA3    +    0 BRGI     +    0 LZI      - 1000 PREP2    =    0
!
MOPREP3)
      6.0 FVSGI    +  6.0 FVSG1    +  5.1 FVSG2    +  4.6 FVSG3    - 1000 PREP3
    =    0
!
```

```
MOPREP5)
      3.5 BDIH     +  3.5 BD/LGIH +  3.5 BD/BSIH +  3.5 BD1H     +  3.5 BD/LG1H
    + 3.5 BD/JT1H +  3.5 BD/JP1H +  3.1 BD2H     +  3.1 BD/LG2H +  3.1 BD/JT2H
    + 3.1 BD/JP2H +  2.8 BD3H     +  2.8 BD/LG3H +  2.8 BD/JT3H +  2.8 BD/JP3H
    + 3.5 BTIH     +  3.5 BT/LGIH +  3.5 BT/BSIH +  3.5 BT1H     +  3.5 BT/LG1H
    + 3.5 BT/JT1H +  3.5 BT/JP1H +  3.1 BT2H     +  3.1 BT/LG2H +  3.1 BT/JT2H
    + 3.1 BT/JP2H +  7.0 OG1H     +  7.0 OG/LG1H +  7.0 OG/JT1H +  7.0 OG/JP1H
    + 6.2 OG2H     +  6.2 OG/LG2H +  6.2 OG/JT2H +  6.2 OG/JP2H +  5.6 OG3H
    + 5.6 OG/LG3H +  5.6 OG/JT3H +  5.6 OG/JP3H
!
    + 3.5 BDIM     +  3.5 BD/LGIM +  3.5 BD/BSIM +  3.5 BD1M     +  3.5 BD/LG1M
    + 3.5 BD/JT1M +  3.5 BD/JP1M +  3.1 BD2M     +  3.1 BD/LG2M +  3.1 BD/JT2M
    + 3.1 BD/JP2M +  2.8 BD3M     +  2.8 BD/LG3M +  2.8 BD/JT3M +  2.8 BD/JP3M
    + 3.5 BTIM     +  3.5 BT/LGIM +  3.5 BT/BSIM +  3.5 BT1M     +  3.5 BT/LG1M
    + 3.5 BT/JT1M +  3.5 BT/JP1M +  3.1 BT2M     +  3.1 BT/LG2M +  3.1 BT/JT2M
    + 3.1 BT/JP2M +  7.0 OG1M     +  7.0 OG/LG1M +  7.0 OG/JT1M +  7.0 OG/JP1M
    + 6.2 OG2M     +  6.2 OG/LG2M +  6.2 OG/JT2M +  6.2 OG/JP2M +  5.6 OG3M
    + 5.6 OG/LG3M +  5.6 OG/JT3M +  5.6 OG/JP3M
!
    + 3.5 BDIT     +  3.5 BD/LGIT +  3.5 BD/BSIT +  3.5 BD1T     +  3.5 BD/LG1T
    + 3.5 BD/JT1T +  3.5 BD/JP1T +  3.1 BD2T     +  3.1 BD/LG2T +  3.1 BD/JT2T
    + 3.1 BD/JP2T +  2.8 BD3T     +  2.8 BD/LG3T +  2.8 BD/JT3T +  2.8 BD/JP3T
    + 3.5 BTIT     +  3.5 BT/LGIT +  3.5 BT/BSIT +  3.5 BT1T     +  3.5 BT/LG1T
    + 3.5 BT/JT1T +  3.5 BT/JP1T +  3.1 BT2T     +  3.1 BT/LG2T +  3.1 BT/JT2T
    + 3.1 BT/JP2T +  7.0 OG1T     +  7.0 OG/LG1T +  7.0 OG/JT1T +  7.0 OG/JP1T
    + 6.2 OG2T     +  6.2 OG/LG2T +  6.2 OG/JT2T +  6.2 OG/JP2T +  5.6 OG3T
    + 5.6 OG/LG3T +  5.6 OG/JT3T +  5.6 OG/JP3T
!
    + 3.1 AU/LG2   +  3.1 AU/JT2   +  2.8 AU/LG3   +  2.8 AU/JT3   +    0 BSI
    + 3.5 FVI      +  3.5 FV/BSI   +  3.5 FV1     +    0 TMI      +    0 PQI
    +   0 PDTI     +  4.7 PDTASI   +    0 PMI     +  8.0 FVVAI    +  8.0 FVA/BSI
    + 8.0 FVVA1    +  7.1 FVVA2    +  6.4 FVVA3   +  8.0 FNVAI    +  8.0 FNVA1
    + 7.1 FNVA2    +  6.4 FNVA3    +  7.0 FVOGI   +  7.0 FVOG1    +  6.2 FVOG2
    + 5.6 FVOG3    +    0 FVSGI    +    0 FVSG1   +    0 FVSG2    +    0 FVSG3
    + 8.0 ENVAI    +  8.0 ENVA1    +  7.1 ENVA2   +  6.4 ENVA3    +  7.0 BRGI
    + 7.0 LZI      - 1000 PREP5    =    0
!
!*************************************************************************
!
!  Epandage des Engrais, Main d'Oeuvre Agricole (heures/ha)
!
!*************************************************************************
!
MOEPAND1)
      .90 BDIH     +  .90 BD/LGIH +  .90 BD/BSIH +  .85 BD1H     +  .85 BD/LG1H
    + .85 BD/JT1H +  .85 BD/JP1H +  .80 BD2H     +  .80 BD/LG2H +  .80 BD/JT2H
    + .80 BD/JP2H +  .80 BD3H     +  .75 BD/LG3H +  .75 BD/JT3H +  .75 BD/JP3H
    + .90 BTIH     +  .90 BT/LGIH +  .90 BT/BSIH +  .85 BT1H     +  .85 BT/LG1H
    + .85 BT/JT1H +  .85 BT/JP1H +  .80 BT2H     +  .80 BT/LG2H +  .80 BT/JT2H
    + .80 BT/JP2H +  .85 OG1H     +  .85 OG/LG1H +  .85 OG/JT1H +  .85 OG/JP1H
    + .80 OG2H     +  .80 OG/LG2H +  .80 OG/JT2H +  .80 OG/JP2H +  .75 OG3H
    + .75 OG/LG3H +  .75 OG/JT3H +  .75 OG/JP3H
!
```

```
    +  .68 BDIM    +  .68 BD/LGIM +  .68 BD/BSIM +  .64 BD1M    +  .64 BD/LG1M
    +  .64 BD/JT1M +  .64 BD/JP1M +  .60 BD2M    +  .60 BD/LG2M +  .60 BD/JT2M
    +  .60 BD/JP2M +  .60 BD3M    +  .56 BD/LG3M +  .56 BD/JT3M +  .56 BD/JP3M
    +  .68 BTIM    +  .68 BT/LGIM +  .68 BT/BSIM +  .64 BT1M    +  .64 BT/LG1M
    +  .64 BT/JT1M +  .64 BT/JP1M +  .60 BT2M    +  .60 BT/LG2M +  .60 BT/JT2M
    +  .60 BT/JP2M +  .64 OG1M    +  .64 OG/LG1M +  .64 OG/JT1M +  .64 OG/JP1M
    +  .60 OG2M    +  .60 OG/LG2M +  .60 OG/JT2M +  .60 OG/JP2M +  .56 OG3M
    +  .56 OG/LG3M +  .56 OG/JT3M +  .56 OG/JP3M
!
    +    0 BDIT    +    0 BD/LGIT +    0 BD/BSIT +    0 BD1T    +    0 BD/LG1T
    +    0 BD/JT1T +    0 BD/JP1T +    0 BD2T    +    0 BD/LG2T +    0 BD/JT2T
    +    0 BD/JP2T +    0 BD3T    +    0 BD/LG3T +    0 BD/JT3T +    0 BD/JP3T
    +    0 BTIT    +    0 BT/LGIT +    0 BT/BSIT +    0 BT1T    +    0 BT/LG1T
    +    0 BT/JT1T +    0 BT/JP1T +    0 BT2T    +    0 BT/LG2T +    0 BT/JT2T
    +    0 BT/JP2T +    0 OG1T    +    0 OG/LG1T +    0 OG/JT1T +    0 OG/JP1T
    +    0 OG2T    +    0 OG/LG2T +    0 OG/JT2T +    0 OG/JP2T +    0 OG3T
    +    0 OG/LG3T +    0 OG/JT3T +    0 OG/JP3T
!
    +  .80 AU/LG2  +  .80 AU/JT2  +  .75 AU/LG3  +  .75 AU/JT3  +  .90 BSI
    +  .90 FVI     +  .90 FV/BSI  +  .85 FV1     +    0 TMI     +    0 PQI
    +    0 PDTI    + 3.60 PDTASI  +    0 PMI     +  .90 FVVAI   +  .90 FVA/BSI
    +  .85 FVVA1   +  .80 FVVA2   +  .75 FVVA3   +  .90 FNVAI   +  .85 FNVA1
    +  .80 FNVA2   +  .75 FNVA3   +  .90 FVOGI   +  .85 FVOG1   +  .80 FVOG2
    +  .70 FVOG3   +    0 FVSGI   +    0 FVSG1   +    0 FVSG2   +    0 FVSG3
    +  .90 ENVAI   +  .85 ENVA1   +  .80 ENVA2   +  .75 ENVA3   + 1.35 BRGI
    + 1.35 LZI     - 1000 EPAND1  =    0
!
MOEPAND2)
       .90 BDIH    +  .90 BD/LGIH +  .90 BD/BSIH +  .85 BD1H    +  .85 BD/LG1H
    +  .85 BD/JT1H +  .85 BD/JP1H +  .80 BD2H    +  .80 BD/LG2H +  .80 BD/JT2H
    +  .80 BD/JP2H +  .75 BD3H    +  .75 BD/LG3H +  .75 BD/JT3H +  .75 BD/JP3H
    +  .90 BTIH    +  .90 BT/LGIH +  .90 BT/BSIH +  .85 BT1H    +  .85 BT/LG1H
    +  .85 BT/JT1H +  .85 BT/JP1H +  .80 BT2H    +  .80 BT/LG2H +  .80 BT/JT2H
    +  .80 BT/JP2H +  .85 OG1H    +  .85 OG/LG1H +  .85 OG/JT1H +  .85 OG/JP1H
    +  .80 OG2H    +  .80 OG/LG2H +  .80 OG/JT2H +  .80 OG/JP2H +  .75 OG3H
    +  .75 OG/LG3H +  .75 OG/JT3H +  .75 OG/JP3H
!
    +  .68 BDIM    +  .68 BD/LGIM +  .68 BD/BSIM +  .64 BD1M    +  .64 BD/LG1M
    +  .64 BD/JT1M +  .64 BD/JP1M +  .60 BD2M    +  .60 BD/LG2M +  .60 BD/JT2M
    +  .60 BD/JP2M +  .56 BD3M    +  .56 BD/LG3M +  .56 BD/JT3M +  .56 BD/JP3M
    +  .68 BTIM    +  .68 BT/LGIM +  .68 BT/BSIM +  .64 BT1M    +  .64 BT/LG1M
    +  .64 BT/JT1M +  .64 BT/JP1M +  .60 BT2M    +  .60 BT/LG2M +  .60 BT/JT2M
    +  .60 BT/JP2M +  .64 OG1M    +  .64 OG/LG1M +  .64 OG/JT1M +  .64 OG/JP1M
    +  .60 OG2M    +  .60 OG/LG2M +  .60 OG/JT2M +  .60 OG/JP2M +  .56 OG3M
    +  .56 OG/LG3M +  .56 OG/JT3M +  .56 OG/JP3M
!
    +    0 BDIT    +    0 BD/LGIT +    0 BD/BSIT +    0 BD1T    +    0 BD/LG1T
    +    0 BD/JT1T +    0 BD/JP1T +    0 BD2T    +    0 BD/LG2T +    0 BD/JT2T
    +    0 BD/JP2T +    0 BD3T    +    0 BD/LG3T +    0 BD/JT3T +    0 BD/JP3T
    +    0 BTIT    +    0 BT/LGIT +    0 BT/BSIT +    0 BT1T    +    0 BT/LG1T
    +    0 BT/JT1T +    0 BT/JP1T +    0 BT2T    +    0 BT/LG2T +    0 BT/JT2T
    +    0 BT/JP2T +    0 OG1T    +    0 OG/LG1T +    0 OG/JT1T +    0 OG/JP1T
    +    0 OG2T    +    0 OG/LG2T +    0 OG/JT2T +    0 OG/JP2T +    0 OG3T
    +    0 OG/LG3T +    0 OG/JT3T +    0 OG/JP3T
```

```
    +  .80 AU/LG2  +  .80 AU/JT2  +  .75 AU/LG3  +  .75 AU/JT3  +  .90 BSI
    +    0 FVI     +    0 FV/BSI  +    0 FV1     +    0 TMI     +    0 PQI
    +    0 PDTI    +    0 PDTASI  +    0 PMI     +  .90 FVVAI   +  .90 FVA/BSI
    +  .85 FVVA1   +  .80 FVVA2   +  .75 FVVA3   +  .90 FNVAI   +  .85 FNVA1
    +  .80 FNVA2   +  .75 FNVA3   +  .90 FVOGI   +  .85 FVOG1   +  .80 FVOG2
    +  .75 FVOG3   +    0 FVSGI   +    0 FVSG1   +    0 FVSG2   +    0 FVSG3
    +  .90 ENVAI   +  .85 ENVA1   +  .80 ENVA2   +  .75 ENVA3   + 1.35 BRGI
    + 1.35 LZI     - 1000 EPAND2  =    0
!
 MOEPAND3)
      1.80 TMI     + 1.80 PQI     + 3.60 PDTI    +    0 PDTASI  + 1.80 PMI
    + 1.80 AUTCMI  + 1.80 FVSGI   + 1.70 FVSG1   + 1.60 FVSG2   + 1.50 FVSG3
                   - 1000 EPAND3  =    0
!
 MOEPAND4)
      1.80 TMI     + 1.80 PQI     +    0 PDTI    +    0 PDTASI  + 1.80 PMI
    + 1.80 AUTCMI  + 1.80 FVSGI   + 1.70 FVSG1   + 1.60 FVSG2   + 1.50 FVSG3
    - 1000 EPAND4  =    0
!
!*************************************************************************
!
!  Semis, Main d'Oeuvre Agricole (heures/ha)
!
!*************************************************************************
!
 MOSEMIS1)
      2.2 BDIH    +  2.2 BD/LGIH +  2.2 BD/BSIH +  2.2 BD1H    +  2.2 BD/LG1H
    +  2.2 BD/JT1H +  2.2 BD/JP1H +  2.0 BD2H    +  2.0 BD/LG2H +  2.0 BD/JT2H
    +  2.0 BD/JP2H +  1.9 BD3H    +  1.9 BD/LG3H +  1.9 BD/JT3H +  1.9 BD/JP3H
    +  2.2 BTIH    +  2.2 BT/LGIH +  2.2 BT/BSIH +  2.2 BT1H    +  2.2 BT/LG1H
    +  2.2 BT/JT1H +  2.2 BT/JP1H +  2.0 BT2H    +  2.0 BT/LG2H +  2.0 BT/JT2H
    +  2.0 BT/JP2H +  2.2 OG1H    +  2.2 OG/LG1H +  2.2 OG/JT1H +  2.2 OG/JP1H
    +  2.0 OG2H    +  2.0 OG/LG2H +  2.0 OG/JT2H +  2.0 OG/JP2H +  1.9 OG3H
    +  1.9 OG/LG3H +  1.9 OG/JT3H +  1.9 OG/JP3H
!
    +  2.2 BDIM    +  2.2 BD/LGIM +  2.2 BD/BSIM +  2.2 BD1M    +  2.2 BD/LG1M
    +  2.2 BD/JT1M +  2.2 BD/JP1M +  2.0 BD2M    +  2.0 BD/LG2M +  2.0 BD/JT2M
    +  2.0 BD/JP2M +  1.9 BD3M    +  1.9 BD/LG3M +  1.9 BD/JT3M +  1.9 BD/JP3M
    +  2.2 BTIM    +  2.2 BT/LGIM +  2.2 BT/BSIM +  2.2 BT1M    +  2.2 BT/LG1M
    +  2.2 BT/JT1M +  2.2 BT/JP1M +  2.0 BT2M    +  2.0 BT/LG2M +  2.0 BT/JT2M
    +  2.0 BT/JP2M +  2.2 OG1M    +  2.2 OG/LG1M +  2.2 OG/JT1M +  2.2 OG/JP1M
    +  2.0 OG2M    +  2.0 OG/LG2M +  2.0 OG/JT2M +  2.0 OG/JP2M +  1.9 OG3M
    +  1.9 OG/LG3M +  1.9 OG/JT3M +  1.9 OG/JP3M
!
    +  2.2 BDIT    +  2.2 BD/LGIT +  2.2 BD/BSIT +  2.2 BD1T    +  2.2 BD/LG1T
    +  2.2 BD/JT1T +  2.2 BD/JP1T +  2.0 BD2T    +  2.0 BD/LG2T +  2.0 BD/JT2T
    +  2.0 BD/JP2T +  1.9 BD3T    +  1.9 BD/LG3T +  1.9 BD/JT3T +  1.9 BD/JP3T
    +  2.2 BTIT    +  2.2 BT/LGIT +  2.2 BT/BSIT +  2.2 BT1T    +  2.2 BT/LG1T
    +  2.2 BT/JT1T +  2.2 BT/JP1T +  2.0 BT2T    +  2.0 BT/LG2T +  2.0 BT/JT2T
    +  2.0 BT/JP2T +  2.2 OG1T    +  2.2 OG/LG1T +  2.2 OG/JT1T +  2.2 OG/JP1T
    +  2.0 OG2T    +  2.0 OG/LG2T +  2.0 OG/JT2T +  2.0 OG/JP2T +  1.9 OG3T
    +  1.9 OG/LG3T +  1.9 OG/JT3T +  1.9 OG/JP3T
!
```

```
    + 2.0 AU/LG2  + 2.0 AU/JT2  + 1.9 AU/LG3  + 1.9 AU/JT3  + 3.4 BSI
    + 40.0 FVI    + 40.0 FV/BSI + 35.0 FV1    +   0 TMI    +   0 PQI
    +   0 PDTI    + 75.0 PDTASI +   0 PMI    + 2.2 FVVAI   + 2.2 FVA/BSI
    + 2.2 FVVA1   + 2.0 FVVA2   + 1.9 FVVA3   + 2.2 FNVAI   + 2.2 FNVA1
    + 2.0 FNVA2   + 1.9 FNVA3   + 2.2 FVOGI   + 2.2 FVOG1   + 2.0 FVOG2
    + 1.9 FVOG3   +   0 FVSGI   +   0 FVSG1   +   0 FVSG2   +   0 FVSG3
    + 2.2 ENVAI   + 2.2 ENVA1   + 2.0 ENVA2   + 1.9 ENVA3   + 2.2 BRGI
    + 2.2 LZI     - 1000 SEMIS1 =   0
!
 MOSEMIS3)
       90 TMI     +  45 PQI     +  75 PDTI    +   0 PDTASI  +  80 PMI
    +  85 AUTCMI  + 2.2 FVSGI   + 2.2 FVSG1   + 2.0 FVSG2   + 1.9 FVSG3
    - 1000 SEMIS3 =   0
!
!*****************************************************************************
!
!  Désherbage, Main d'Oeuvre Agricole (heures/ha)
!
!*****************************************************************************
!
 MODESH1)
      120 PDTASI  - 1000 DESHER1 =   0
!
 MODESH2)
      2.5 BDIH    + 2.5 BD/LGIH + 2.5 BD/BSIH + 1.7 BD1H    + 1.7 BD/LG1H
    + 1.7 BD/JT1H + 1.7 BD/JP1H + 1.3 BD2H    + 1.3 BD/LG2H + 1.3 BD/JT2H
    + 1.3 BD/JP2H + 1.1 BD3H    + 1.1 BD/LG3H + 1.1 BD/JT3H + 1.1 BD/JP3H
    + 2.5 BTIH    + 2.5 BT/LGIH + 2.5 BT/BSIH + 1.7 BT1H    + 1.7 BT/LG1H
    + 1.7 BT/JT1H + 1.7 BT/JP1H + 1.3 BT2H    + 1.3 BT/LG2H + 1.3 BT/JT2H
    + 1.3 BT/JP2H + 3.4 OG1H    + 3.4 OG/LG1H + 3.4 OG/JT1H + 3.4 OG/JP1H
    + 2.6 OG2H    + 2.6 OG/LG2H + 2.6 OG/JT2H + 2.6 OG/JP2H + 2.2 OG3H
    + 2.2 OG/LG3H + 2.2 OG/JT3H + 2.2 OG/JP3H
!
    + 2.5 BDIM    + 2.5 BD/LGIM + 2.5 BD/BSIM + 1.7 BD1M    + 1.7 BD/LG1M
    + 1.7 BD/JT1M + 1.7 BD/JP1M + 1.3 BD2M    + 1.3 BD/LG2M + 1.3 BD/JT2M
    + 1.3 BD/JP2M + 1.1 BD3M    + 1.1 BD/LG3M + 1.1 BD/JT3M + 1.1 BD/JP3M
    + 2.5 BTIM    + 2.5 BT/LGIM + 2.5 BT/BSIM + 1.7 BT1M    + 1.7 BT/LG1M
    + 1.7 BT/JT1M + 1.7 BT/JP1M + 1.3 BT2M    + 1.3 BT/LG2M + 1.3 BT/JT2M
    + 1.3 BT/JP2M + 3.4 OG1M    + 3.4 OG/LG1M + 3.4 OG/JT1M + 3.4 OG/JP1M
    + 2.6 OG2M    + 2.6 OG/LG2M + 2.6 OG/JT2M + 2.6 OG/JP2M + 2.2 OG3M
    + 2.2 OG/LG3M + 2.2 OG/JT3M + 2.2 OG/JP3M
!
    + 2.5 BDIT    + 2.5 BD/LGIT + 2.5 BD/BSIT + 1.7 BD1T    + 1.7 BD/LG1T
    + 1.7 BD/JT1T + 1.7 BD/JP1T + 1.3 BD2T    + 1.3 BD/LG2T + 1.3 BD/JT2T
    + 1.3 BD/JP2T + 1.1 BD3T    + 1.1 BD/LG3T + 1.1 BD/JT3T + 1.1 BD/JP3T
    + 2.5 BTIT    + 2.5 BT/LGIT + 2.5 BT/BSIT + 1.7 BT1T    + 1.7 BT/LG1T
    + 1.7 BT/JT1T + 1.7 BT/JP1T + 1.3 BT2T    + 1.3 BT/LG2T + 1.3 BT/JT2T
    + 1.3 BT/JP2T + 3.4 OG1T    + 3.4 OG/LG1T + 3.4 OG/JT1T + 3.4 OG/JP1T
    + 2.6 OG2T    + 2.6 OG/LG2T + 2.6 OG/JT2T + 2.6 OG/JP2T + 2.2 OG3T
    + 2.2 OG/LG3T + 2.2 OG/JT3T + 2.2 OG/JP3T
!
    + 1.3 AU/LG2  + 1.3 AU/JT2  + 1.1 AU/LG3  + 1.1 AU/JT3  + 94.5 BSI
    + 40.5 FVI    + 40.5 FV/BSI + 40.5 FV1    +   0 TMI    +   0 PQI
    +   0 PDTI    + 120 PDTASI  +   0 PMI    - 1000 DESHER2 =   0
!
```

```
 MODESH3)
       2.5 BDIH     +  2.5 BD/LGIH +  2.5 BD/BSIH +  1.7 BD1H     +  1.7 BD/LG1H
    +  1.7 BD/JT1H +  1.7 BD/JP1H +  1.3 BD2H     +  1.3 BD/LG2H +  1.3 BD/JT2H
    +  1.3 BD/JP2H +  1.1 BD3H     +  1.1 BD/LG3H +  1.1 BD/JT3H +  1.1 BD/JP3H
    +  2.5 BTIH     +  2.5 BT/LGIH +  2.5 BT/BSIH +  1.7 BT1H     +  1.7 BT/LG1H
    +  1.7 BT/JT1H +  1.7 BT/JP1H +  1.3 BT2H     +  1.3 BT/LG2H +  1.3 BT/JT2H
    +  1.3 BT/JP2H +    0 OG1H     +    0 OG/LG1H +    0 OG/JT1H +    0 OG/JP1H
    +    0 OG2H     +    0 OG/LG2H +    0 OG/JT2H +    0 OG/JP2H +    0 OG3H
    +    0 OG/LG3H +    0 OG/JT3H +    0 OG/JP3H
!
    +  2.5 BDIM     +  2.5 BD/LGIM +  2.5 BD/BSIM +  1.7 BD1M     +  1.7 BD/LG1M
    +  1.7 BD/JT1M +  1.7 BD/JP1M +  1.3 BD2M     +  1.3 BD/LG2M +  1.3 BD/JT2M
    +  1.3 BD/JP2M +  1.1 BD3M     +  1.1 BD/LG3M +  1.1 BD/JT3M +  1.1 BD/JP3M
    +  2.5 BTIM     +  2.5 BT/LGIM +  2.5 BT/BSIM +  1.7 BT1M     +  1.7 BT/LG1M
    +  1.7 BT/JT1M +  1.7 BT/JP1M +  1.3 BT2M     +  1.3 BT/LG2M +  1.3 BT/JT2M
    +  1.3 BT/JP2M +    0 OG1M     +    0 OG/LG1M +    0 OG/JT1M +    0 OG/JP1M
    +    0 OG2M     +    0 OG/LG2M +    0 OG/JT2M +    0 OG/JP2M +    0 OG3M
    +    0 OG/LG3M +    0 OG/JT3M +    0 OG/JP3M
!
    +  2.5 BDIT     +  2.5 BD/LGIT +  2.5 BD/BSIT +  1.7 BD1T     +  1.7 BD/LG1T
    +  1.7 BD/JT1T +  1.7 BD/JP1T +  1.3 BD2T     +  1.3 BD/LG2T +  1.3 BD/JT2T
    +  1.3 BD/JP2T +  1.1 BD3T     +  1.1 BD/LG3T +  1.1 BD/JT3T +  1.1 BD/JP3T
    +  2.5 BTIT     +  2.5 BT/LGIT +  2.5 BT/BSIT +  1.7 BT1T     +  1.7 BT/LG1T
    +  1.7 BT/JT1T +  1.7 BT/JP1T +  1.3 BT2T     +  1.3 BT/LG2T +  1.3 BT/JT2T
    +  1.3 BT/JP2T +    0 OG1T     +    0 OG/LG1T +    0 OG/JT1T +    0 OG/JP1T
    +    0 OG2T     +    0 OG/LG2T +    0 OG/JT2T +    0 OG/JP2T +    0 OG3T
    +    0 OG/LG3T +    0 OG/JT3T +    0 OG/JP3T
!
    +  1.3 AU/LG2   +  1.3 AU/JT2   +  1.1 AU/LG3   +  1.1 AU/JT3   + 94.5 BSI
    + 40.5 FVI      + 40.5 FV/BSI   + 40.5 FV1      +  260 TMI      +  240 PQI
    +  120 PDTI     +    0 PDTASI   +  230 PMI      +  250 AUTCMI
    - 1000 DESHER3 =    0
!
 MODESH4)
       260 TMI      +  100 PQI      +  120 PDTI     +    0 PDTASI   +  230 PMI
    +  245 AUTCMI   - 1000 DESHER4                  =    0
!
!*****************************************************************************
!
!  Moisson, Main d'Oeuvre Agricole (heures/ha)
!
!*****************************************************************************
!
 MOMOIS1)
       90 TMI       +    0 PQI      +    0 PDTI     +    0 PDTASI   +   80 PMI
    +  85 AUTCMI    - 1000 MOISS1   =    0
!
 MOMOIS2)
      150 PDTASI    - 1000 MOISS2   =    0
!
```

```
MOMOIS4)
      4.2 BDIH     +  4.2 BD/LGIH +  4.2 BD/BSIH +  3.8 BD1H     +  3.8 BD/LG1H
    + 4.3 BD/JT1H + 3.8 BD/JP1H +  3.4 BD2H     +  3.4 BD/LG2H +  3.8 BD/JT2H
    + 3.4 BD/JP2H + 2.9 BD3H     +  2.9 BD/LG3H +  3.2 BD/JT3H +  2.9 BD/JP3H
    + 4.6 BTIH     +  4.6 BT/LGIH +  4.6 BT/BSIH +  4.0 BT1H     +  4.0 BT/LG1H
    + 4.9 BT/JT1H + 4.0 BT/JP1H +  3.4 BT2H     +  3.4 BT/LG2H +  4.0 BT/JT2H
    + 3.4 BT/JP2H + 7.6 OG1H     +  7.6 OG/LG1H +  8.2 OG/JT1H +  7.6 OG/JP1H
    + 7.0 OG2H     +  7.0 OG/LG2H +  7.8 OG/JT2H +  7.0 OG/JP2H +  6.4 OG3H
    + 6.4 OG/LG3H + 6.8 OG/JT3H +  6.4 OG/JP3H
!
    + 4.0 BDIM     +  4.0 BD/LGIM +  4.0 BD/BSIM +  3.6 BD1M     +  3.6 BD/LG1M
    + 4.1 BD/JT1M + 3.6 BD/JP1M +  3.3 BD2M     +  3.3 BD/LG2M +  3.7 BD/JT2M
    + 3.3 BD/JP2M + 2.8 BD3M     +  2.8 BD/LG3M +  3.1 BD/JT3M +  2.8 BD/JP3M
    + 4.4 BTIM     +  4.4 BT/LGIM +  4.4 BT/BSIM +  3.8 BT1M     +  3.8 BT/LG1M
    + 4.6 BT/JT1M + 3.8 BT/JP1M +  3.3 BT2M     +  3.3 BT/LG2M +  3.9 BT/JT2M
    + 3.3 BT/JP2M + 7.2 OG1M     +  7.2 OG/LG1M +  7.8 OG/JT1M +  7.2 OG/JP1M
    + 6.8 OG2M     +  6.8 OG/LG2M +  7.4 OG/JT2M +  6.8 OG/JP2M +  6.2 OG3M
    + 6.2 OG/LG3M + 6.5 OG/JT3M +  6.2 OG/JP3M
!
    + 3.7 BDIT     +  3.7 BD/LGIT +  3.7 BD/BSIT +  3.3 BD1T     +  3.3 BD/LG1T
    + 3.8 BD/JT1T + 3.3 BD/JP1T +  3.1 BD2T     +  3.1 BD/LG2T +  3.5 BD/JT2T
    + 3.1 BD/JP2T + 2.7 BD3T     +  2.7 BD/LG3T +  3.0 BD/JT3T +  2.7 BD/JP3T
    + 4.0 BTIT     +  4.0 BT/LGIT +  4.0 BT/BSIT +  3.4 BT1T     +  3.4 BT/LG1T
    + 4.2 BT/JT1T + 3.4 BT/JP1T +  3.1 BT2T     +  3.1 BT/LG2T +  3.7 BT/JT2T
    + 3.1 BT/JP2T + 6.6 OG1T     +  6.6 OG/LG1T +  7.2 OG/JT1T +  6.6 OG/JP1T
    + 6.4 OG2T     +  6.4 OG/LG2T +  7.0 OG/JT2T +  6.4 OG/JP2T +  6.0 OG3T
    + 6.0 OG/LG3T + 6.4 OG/JT3T +  6.0 OG/JP3T
!
    + 6.4 AU/LG2   +  7.0 AU/JT2   +  6.0 AU/LG3   +  6.4 AU/JT3   +  200 BSI
    + 150 PDTI     +  108 FVI      +  108 FV/BSI   +  108 FV1      - 1000 MOISS4
    =   0
!
MOMOIS5)
      4.2 BDIH     +  4.2 BD/LGIH +  4.2 BD/BSIH +  3.8 BD1H     +  3.8 BD/LG1H
    + 4.3 BD/JT1H + 3.8 BD/JP1H +  3.4 BD2H     +  3.4 BD/LG2H +  3.8 BD/JT2H
    + 3.4 BD/JP2H + 2.9 BD3H     +  2.9 BD/LG3H +  3.2 BD/JT3H +  2.9 BD/JP3H
    + 4.6 BTIH     +  4.6 BT/LGIH +  4.6 BT/BSIH +  4.0 BT1H     +  4.0 BT/LG1H
    + 4.9 BT/JT1H + 4.0 BT/JP1H +  3.4 BT2H     +  3.4 BT/LG2H +  4.0 BT/JT2H
    + 3.4 BT/JP2H +   0 OG1H     +    0 OG/LG1H +    0 OG/JT1H +    0 OG/JP1H
    +   0 OG2H     +   0 OG/LG2H +    0 OG/JT2H +    0 OG/JP2H +    0 OG3H
    +   0 OG/LG3H +   0 OG/JT3H +    0 OG/JP3H
!
    + 4.0 BDIM     +  4.0 BD/LGIM +  4.0 BD/BSIM +  3.6 BD1M     +  3.6 BD/LG1M
    + 4.1 BD/JT1M + 3.6 BD/JP1M +  3.3 BD2M     +  3.3 BD/LG2M +  3.7 BD/JT2M
    + 3.3 BD/JP2M + 2.8 BD3M     +  2.8 BD/LG3M +  3.1 BD/JT3M +  2.8 BD/JP3M
    + 4.4 BTIM     +  4.4 BT/LGIM +  4.4 BT/BSIM +  3.8 BT1M     +  3.8 BT/LG1M
    + 4.6 BT/JT1M + 3.8 BT/JP1M +  3.3 BT2M     +  3.3 BT/LG2M +  3.9 BT/JT2M
    + 3.3 BT/JP2M +   0 OG1M     +    0 OG/LG1M +    0 OG/JT1M +    0 OG/JP1M
    +   0 OG2M     +   0 OG/LG2M +    0 OG/JT2M +    0 OG/JP2M +    0 OG3M
    +   0 OG/LG3M +   0 OG/JT3M +    0 OG/JP3M
!
```

```
    + 3.7 BDIT    + 3.7 BD/LGIT + 3.7 BD/BSIT + 3.3 BD1T    + 3.3 BD/LG1T
    + 3.8 BD/JT1T + 3.3 BD/JP1T + 3.1 BD2T    + 3.1 BD/LG2T + 3.5 BD/JT2T
    + 3.1 BD/JP2T + 2.7 BD3T    + 2.7 BD/LG3T + 3.0 BD/JT3T + 2.7 BD/JP3T
    + 4.0 BTIT    + 4.0 BT/LGIT + 4.0 BT/BSIT + 3.4 BT1T    + 3.4 BT/LG1T
    + 4.2 BT/JT1T + 3.4 BT/JP1T + 3.1 BT2T    + 3.1 BT/LG2T + 3.7 BT/JT2T
    + 3.1 BT/JP2T +   0 OG1T    +   0 OG/LG1T +   0 OG/JT1T +   0 OG/JP1T
    +   0 OG2T    +   0 OG/LG2T +   0 OG/JT2T +   0 OG/JP2T +   0 OG3T
    +   0 OG/LG3T +   0 OG/JT3T +   0 OG/JP3T
!
    +   0 AU/LG2  +   0 AU/JT2  +   0 AU/LG3  +   0 AU/JT3  +   0 BSI
    +   0 FVI     +   0 FV/BSI  +   0 FV1     + 450 TMI     + 130 PQI
    +   0 PDTASI  + 450 PMI     + 450 AUTCMI  - 1000 MOISS5 =   0
!
!*****************************************************************************
!
!  Mecanisation--Préparation du Sol, Epandage des Engrais, Semis, et Désherbage
!  (heure/ha)
!
!*****************************************************************************
!
TRACTION)
      6.7 BDIH    + 6.7 BD/LGIH + 6.7 BD/BSIH + 6.5 BD1H    + 6.5 BD/LG1H
    + 6.5 BD/JT1H + 6.5 BD/JP1H + 6.3 BD2H    + 6.3 BD/LG2H + 6.3 BD/JT2H
    + 6.3 BD/JP2H + 6.1 BD3H    + 6.1 BD/LG3H + 6.1 BD/JT3H + 6.1 BD/JP3H
    + 6.7 BTIH    + 6.7 BT/LGIH + 6.7 BT/BSIH + 6.5 BT1H    + 6.5 BT/LG1H
    + 6.5 BT/JT1H + 6.5 BT/JP1H + 6.3 BT2H    + 6.3 BT/LG2H + 6.3 BT/JT2H
    + 6.3 BT/JP2H + 4.5 OG1H    + 4.5 OG/LG1H + 4.5 OG/JT1H + 4.5 OG/JP1H
    + 4.3 OG2H    + 4.3 OG/LG2H + 4.3 OG/JT2H + 4.3 OG/JP2H + 4.1 OG3H
    + 4.1 OG/LG3H + 4.1 OG/JT3H + 4.1 OG/JP3H
!
    + 6.7 BDIM    + 6.7 BD/LGIM + 6.7 BD/BSIM + 6.5 BD1M    + 6.5 BD/LG1M
    + 6.5 BD/JT1M + 6.5 BD/JP1M + 6.3 BD2M    + 6.3 BD/LG2M + 6.3 BD/JT2M
    + 6.3 BD/JP2M + 6.1 BD3M    + 6.1 BD/LG3M + 6.1 BD/JT3M + 6.1 BD/JP3M
    + 6.7 BTIM    + 6.7 BT/LGIM + 6.7 BT/BSIM + 6.5 BT1M    + 6.5 BT/LG1M
    + 6.5 BT/JT1M + 6.5 BT/JP1M + 6.3 BT2M    + 6.3 BT/LG2M + 6.3 BT/JT2M
    + 6.3 BT/JP2M + 4.5 OG1M    + 4.5 OG/LG1M + 4.5 OG/JT1M + 4.5 OG/JP1M
    + 4.3 OG2M    + 4.3 OG/LG2M + 4.3 OG/JT2M + 4.3 OG/JP2M + 4.1 OG3M
    + 4.1 OG/LG3M + 4.1 OG/JT3M + 4.1 OG/JP3M
!
    + 6.7 BDIT    + 6.7 BD/LGIT + 6.7 BD/BSIT + 6.5 BD1T    + 6.5 BD/LG1T
    + 6.5 BD/JT1T + 6.5 BD/JP1T + 6.3 BD2T    + 6.3 BD/LG2T + 6.3 BD/JT2T
    + 6.3 BD/JP2T + 6.1 BD3T    + 6.1 BD/LG3T + 6.1 BD/JT3T + 6.1 BD/JP3T
    + 6.7 BTIT    + 6.7 BT/LGIT + 6.7 BT/BSIT + 6.5 BT1T    + 6.5 BT/LG1T
    + 6.5 BT/JT1T + 6.5 BT/JP1T + 6.3 BT2T    + 6.3 BT/LG2T + 6.3 BT/JT2T
    + 6.3 BT/JP2T + 4.5 OG1T    + 4.5 OG/LG1T + 4.5 OG/JT1T + 4.5 OG/JP1T
    + 4.3 OG2T    + 4.3 OG/LG2T + 4.3 OG/JT2T + 4.3 OG/JP2T + 4.1 OG3T
    + 4.1 OG/LG3T + 4.1 OG/JT3T + 4.1 OG/JP3T
!
```

```
    + 6.3 AU/LG2  + 6.3 AU/JT2  + 6.1 AU/LG3  + 6.1 AU/JT3  + 4.5 FVI
    + 4.5 FV/BSI  + 4.3 FV1     + 10.0 BSI    + 4.5 TMI     + 5.5 PQI
    + 6.5 PDTI    + 6.5 PDTASI  + 4.5 PMI     + 4.5 AUTCMI  + 8.0 FVVAI
    + 8.0 FVA/BSI + 7.8 FVVA1   + 7.6 FVVA2   + 7.4 FVVA3   + 8.0 FNVAI
    + 7.8 FNVA1   + 7.6 FNVA2   + 7.4 FNVA3   + 8.0 FVOGI   + 7.8 FVOG1
    + 7.6 FVOG2   + 7.4 FVOG3   + 8.0 FVSGI   + 7.8 FVSG1   + 7.6 FVSG2
    + 7.4 FVSG3   + 8.0 ENVAI   + 7.8 ENVA1   + 7.6 ENVA2   + 7.4 ENVA3
    + 8.0 ENMSI   + 8.0 ENSGI   + 8.0 BRGI    + 8.0 LZI     + 3.0 JT2
    + 3.0 JT1     + 3.0 JT3     - 1000 TRACTN               =     0
!
!*****************************************************************************
!
!  Fouchage et Rattelage, Main d'Oeuvre Agricole et Mecanisation (heure/ha)
!
!*****************************************************************************
!
 MOFURU3)
      3.2 FNVAI   + 3.1 FNVA1   + 3.0 FNVA2   + 3.3 FNVA3   - 1000 TRAVFUR3
                                                            =     0
 FOUROU3)
      3.2 FNVAI   + 3.1 FNVA1   + 3.0 FNVA2   + 3.3 FNVA3   - 1000 MECHFN3
                                                            =     0
!
!*****************************************************************************
!
!  Fanage, Mise en Meules et Transport, Main d'Oeuvre Agricole (heure/ha)
!
!*****************************************************************************
!
 MOPRESS3)
    +   20 PRDPAL1 +  20 PRDPAL2  +   20 PRDPAL3 +   20 PRDPAL4 +   20 PRDPAL5
    + 138 FNVAI    + 108 FNVA1    +   89 FNVA2   +   59 FNVA3   - 1000 TRAVFN3
                                                            <=    0
 PRESS3)
    +   .8 PRDPAL1 +  .8 PRDPAL2  +   .8 PRDPAL3 +   .8 PRDPAL4 +   .8 PRDPAL5
    + 4.8 FNVAI    +   4 FNVA1    +  3.2 FNVA2   +  2.4 FNVA3   - 1000 PRESS3
                                                            <=    0
!
!*****************************************************************************
!
!  Recolté Fourrage Vert (heure/ha)
!
!*****************************************************************************
!
 RECFV1)
        0 BRGI    +   43 LZI      +    0 FVVAI   +    0 FVA/BSI +    0 FVVA1
  +     0 FVVA2   +    0 FVVA3    +    0 FVOGI   +    0 FVOG1   +    0 FVOG2
  +     0 FVOG3   +   48 FVSGI    +   38 FVSG1   +   29 FVSG2   +   19 FVSG3
  - 1000 TRAVFV1 -39000 MECHFV1                             <=    0
!
 RECFV2)
      168 BRGI    +   65 LZI      +    0 FVVAI   +    0 FVA/BSI +    0 FVVA1
  +     0 FVVA2   +    0 FVVA3    +    0 FVOGI   +    0 FVOG1   +    0 FVOG2
  +     0 FVOG3   +    0 FVSGI    +    0 FVSG1   +    0 FVSG2   +    0 FVSG3
  - 1000 TRAVFV2 -39000 MECHFV2                             <=    0
!
```

```
 RECFV3)
      168 BRGI     +    65 LZI       +  130 FVVAI    +  130 FVA/BSI +  105 FVVA1
   +   80 FVVA2    +    50 FVVA3     +  155 FVOGI    +  125 FVOG1   +  100 FVOG2
   +   75 FVOG3    +     0 FVSGI     +    0 FVSG1    +    0 FVSG2   +    0 FVSG3
   - 1000 TRAVFV3 -42000 MECHFV3                                   <=    0
!
 RECFV4)
        0 BRGI     +    75 LZI       +    0 FVVAI    +    0 FVA/BSI +    0 FVVA1
   +    0 FVVA2    +     0 FVVA3     +    0 FVOGI    +    0 FVOG1   +    0 FVOG2
   +    0 FVOG3    +   120 FVSGI     +   96 FVSG1    +   77 FVSG2   +   65 FVSG3
   - 1000 TRAVFV4 -42000 MECHFV4                                   <=    0
!
 RECFV5)
        0 BRGI     +    21 LZI       +    0 FVVAI    +    0 FVA/BSI +    0 FVVA1
   +    0 FVVA2    +     0 FVVA3     +    0 FVOGI    +    0 FVOG1   +    0 FVOG2
   +    0 FVOG3    +   168 FVSGI     +  134 FVSG1    +  106 FVSG2   +   62 FVSG3
   - 1000 TRAVFV5 -42000 MECHFV5                                   <=    0
!
 MECHFV1)                MECHFV1                                   <=  100
 MECHFV2)                MECHFV2                                   <=  150
 MECHFV3)                MECHFV3                                   <=  150
 MECHFV4)                MECHFV4                                   <=  100
 MECHFV5)                MECHFV5                                   <=  100
!
!*****************************************************************************
!
!  Recolté Ensilage, Main d'Oeuvre Agricole et Mecanisation (One tractor
!  pulling cutter and wagon, and second tractor pulling wagon transporting
!  ensilage, two workers) (heures/ha)
!
!*****************************************************************************
!
 MORECEN3)
        4 ENAVI    +   3.6 ENVA1     +   3.2 ENVA2    +   2.8 ENVA3   +    0 ENMSI
   +    0 ENSGI    - 1000 TRAVEN3                                   <=    0
!
 MORECEN4)
        0 ENAVI    +     0 ENVA1     +     0 ENVA2    +     0 ENVA3   +    6 ENMSI
   +    6 ENSGI    - 1000 TRAVEN4                                   <=    0
!
 RECEN3)
        2 ENAVI    +   1.8 ENVA1     +   1.6 ENVA2    +   1.4 ENVA3   +    0 ENMSI
   +    0 ENSGI                      - 1000 MECHEN3                 <=    0
!
 RECEN4)
        0 ENAVI    +     0 ENVA1     +     0 ENVA2    +     0 ENVA3   +    3 ENMSI
   +    3 ENSGI                      - 1000 MECHEN4                 <=    0
!
 MECHEN3)                MECHEN3                                   <=   50
 MECHEN4)                MECHEN4                                   <=   50
!
```

```
!*************************************************************************
!
!  Mecanisation--Traitement Betterave  Sucre (heure/ha)
!
!*************************************************************************
!
 BSTRAIT)              2 BSI                        - 1000 BSTRAIT =    0
!
!*************************************************************************
!
!  Mecanisation--Moisson (heure/ha)
!
!*************************************************************************
!
 MOISS)
       2.0 BDIH     +  2.0 BD/LGIH +  2.0 BD/BSIH +  1.5 BD1H     +  1.5 BD/LG1H
    +  1.7 BD/JT1H +  1.5 BD/JP1H +  1.3 BD2H     +  1.3 BD/LG2H +  1.5 BD/JT2H
    +  1.3 BD/JP2H +  1.1 BD3H     +  1.1 BD/LG3H +  1.3 BD/JT3H +  1.1 BD/JP3H
    +  2.0 BTIH     +  2.0 BT/LGIH +  2.0 BT/BSIH +  1.5 BT1H     +  1.5 BT/LG1H
    +  1.7 BT/JT1H +  1.5 BT/JP1H +  1.3 BT2H     +  1.3 BT/LG2H +  1.5 BT/JT2H
    +  1.3 BT/JP2H +  1.3 OG1H     +  1.3 OG/LG1H +  1.4 OG/JT1H +  1.3 OG/JP1H
    +  1.2 OG2H     +  1.2 OG/LG2H +  1.3 OG/JT2H +  1.2 OG/JP2H +  1.1 OG3H
    +  1.1 OG/LG3H +  1.2 OG/JT3H +  1.1 OG/JP3H
!
    +  2.0 BDIM     +  2.0 BD/LGIM +  2.0 BD/BSIM +  1.5 BD1M     +  1.5 BD/LG1M
    +  1.7 BD/JT1M +  1.5 BD/JP1M +  1.3 BD2M     +  1.3 BD/LG2M +  1.5 BD/JT2M
    +  1.3 BD/JP2M +  1.1 BD3M     +  1.1 BD/LG3M +  1.3 BD/JT3M +  1.1 BD/JP3M
    +  2.0 BTIM     +  2.0 BT/LGIM +  2.0 BT/BSIM +  1.5 BT1M     +  1.5 BT/LG1M
    +  1.7 BT/JT1M +  1.5 BT/JP1M +  1.3 BT2M     +  1.3 BT/LG2M +  1.5 BT/JT2M
    +  1.3 BT/JP2M +  1.3 OG1M     +  1.3 OG/LG1M +  1.4 OG/JT1M +  1.3 OG/JP1M
    +  1.2 OG2M     +  1.2 OG/LG2M +  1.3 OG/JT2M +  1.2 OG/JP2M +  1.1 OG3M
    +  1.1 OG/LG3M +  1.2 OG/JT3M +  1.1 OG/JP3M
!
    +  2.0 BDIT     +  2.0 BD/LGIT +  2.0 BD/BSIT +  1.5 BD1T     +  1.5 BD/LG1T
    +  1.7 BD/JT1T +  1.5 BD/JP1T +  1.3 BD2T     +  1.3 BD/LG2T +  1.5 BD/JT2T
    +  1.3 BD/JP2T +  1.1 BD3T     +  1.1 BD/LG3T +  1.3 BD/JT3T +  1.1 BD/JP3T
    +  2.0 BTIT     +  2.0 BT/LGIT +  2.0 BT/BSIT +  1.5 BT1T     +  1.5 BT/LG1T
    +  1.7 BT/JT1T +  1.5 BT/JP1T +  1.3 BT2T     +  1.3 BT/LG2T +  1.5 BT/JT2T
    +  1.3 BT/JP2T +  1.3 OG1T     +  1.3 OG/LG1T +  1.4 OG/JT1T +  1.3 OG/JP1T
    +  1.2 OG2T     +  1.2 OG/LG2T +  1.3 OG/JT2T +  1.2 OG/JP2T +  1.1 OG3T
    +  1.1 OG/LG3T +  1.2 OG/JT3T +  1.1 OG/JP3T
!
    +  1.5 FVI      +  1.5 FV/BSI  +  1.0 FV1      - 1000 MOISS    =    0
!
!*************************************************************************
!
!  Transport Fourrage, Foin, Paille et Recolté (Dinars/ha)
!
!*************************************************************************
!
```

```
TRANS)
        6 BDIH     +    6 BD/LGIH +    6 BD/BSIH +  5.5 BD1H     +  5.5 BD/LG1H
    +  5.7 BD/JT1H +  5.5 BD/JP1H +    5 BD2H     +    5 BD/LG2H +  5.2 BD/JT2H
    +    5 BD/JP2H +    4 BD3H     +    4 BD/LG3H +  4.2 BD/JT3H +    4 BD/JP3H
    +    7 BTIH     +    7 BT/LGIH +    7 BT/BSIH +    6 BT1H     +    6 BT/LG1H
    +  6.2 BT/JT1H +    6 BT/JP1H +    5 BT2H     +    5 BT/LG2H +  5.2 BT/JT2H
    +    5 BT/JP2H +    5 OG1H     +    5 OG/LG1H +  5.2 OG/JT1H +    5 OG/JP1H
    +  4.7 OG2H     +  4.7 OG/LG2H +    5 OG/JT2H +  4.7 OG/JP2H +  4.5 OG3H
    +  4.5 OG/LG3H +  4.7 OG/JT3H +  4.5 OG/JP3H
!
    +  5.5 BDIM     +  5.5 BD/LGIM +  5.5 BD/BSIM +    5 BD1M     +    5 BD/LG1M
    +  5.2 BD/JT1M +    5 BD/JP1M +  4.5 BD2M     +  4.5 BD/LG2M +  4.7 BD/JT2M
    +  4.5 BD/JP2M +  3.5 BD3M     +  3.5 BD/LG3M +  3.7 BD/JT3M +  3.5 BD/JP3M
    +  6.5 BTIM     +  6.5 BT/LGIM +  6.5 BT/BSIM +  5.5 BT1M     +  5.5 BT/LG1M
    +  5.7 BT/JT1M +  5.5 BT/JP1M +  4.5 BT2M     +  4.5 BT/LG2M +  4.7 BT/JT2M
    +  4.5 BT/JP2M +  4.5 OG1M     +  4.5 OG/LG1M +  4.7 OG/JT1M +  4.5 OG/JP1M
    +  4.2 OG2M     +  4.2 OG/LG2M +  4.5 OG/JT2M +  4.2 OG/JP2M +    4 OG3M
    +    4 OG/LG3M +  4.2 OG/JT3M +    4 OG/JP3M
!
    +    5 BDIT     +    5 BD/LGIT +    5 BD/BSIT +  4.5 BD1T     +  4.5 BD/LG1T
    +  4.7 BD/JT1T +  4.5 BD/JP1T +    4 BD2T     +    4 BD/LG2T +  4.2 BD/JT2T
    +    4 BD/JP2T +    3 BD3T     +    3 BD/LG3T +  3.2 BD/JT3T +    3 BD/JP3T
    +    6 BTIT     +    6 BT/LGIT +    6 BT/BSIT +    5 BT1T     +    5 BT/LG1T
    +  5.2 BT/JT1T +    5 BT/JP1T +    4 BT2T     +    4 BT/LG2T +  4.2 BT/JT2T
    +    4 BT/JP2T +    4 OG1T     +    4 OG/LG1T +  4.2 OG/JT1T +    4 OG/JP1T
    +  3.7 OG2T     +  3.7 OG/LG2T +    4 OG/JT2T +  3.7 OG/JP2T +  3.5 OG3T
    +  3.5 OG/LG3T +  3.7 OG/JT3T +  3.5 OG/JP3T
!
    +  4.2 AU/LG2   +  4.7 AU/JT2   +    4 AU/LG3   +  4.2 AU/JT3   +  2.5 FVI
    +  2.5 FV/BSI   +  1.6 FV1      +   35 BSI      +   50 TMI      +   50 PQI
    +   50 PDTI     +   50 PDTASI   +   50 PMI      +   50 AUTCMI   + 12.0 FVVAI
    + 12.0 FVA/BSI  +  9.0 FVVA1    +  8.0 FVVA2    +  7.0 FVVA3    +    6 FNVAI
    +  5.5 FNVA1    +    5 FNVA2    +  4.5 FNVA3    + 12.0 FVOGI    +  9.0 FVOG1
    +  8.0 FVOG2    +  7.0 FVOG3    + 14.0 FVSGI    + 12.0 FVSG1    + 11.0 FVSG2
    + 10.0 FVSG3    + 15.0 BRGI     + 15.0 LZI      - 1000 TRANSPT
                    =    0
!
!*****************************************************************************
!
!  Engrais--Ammonitre (tonne/ha)
!
!*****************************************************************************
!
AMMON)
      .150 BDIH     + .100 BD/LGIH + .150 BD/BSIH + .130 BD1H     + .085 BD/LG1H
    + .130 BD/JT1H + .130 BD/JP1H + .110 BD2H     + .075 BD/LG2H + .110 BD/JT2H
    + .110 BD/JP2H + .095 BD3H     + .065 BD/LG3H + .095 BD/JT3H + .095 BD/JP3H
    + .150 BTIH     + .100 BT/LGIH + .150 BT/BSIH + .130 BT1H     + .085 BT/LG1H
    + .130 BT/JT1H + .130 BT/JP1H + .110 BT2H     + .075 BT/LG2H + .110 BT/JT2H
    + .110 BT/JP2H + .130 OG1H     + .085 OG/LG1H + .130 OG/JT1H + .130 OG/JP1H
    + .110 OG2H     + .075 OG/LG2H + .110 OG/JT2H + .110 OG/JP2H + .095 OG3H
    + .065 OG/LG3H + .095 OG/JT3H + .095 OG/JP3H
!
```

```
    + .075 BDIM    + .050 BD/LGIM + .075 BD/BSIM + .065 BD1M    + .043 BD/LG1M
    + .065 BD/JT1M + .065 BD/JP1M + .055 BD2M    + .038 BD/LG2M + .055 BD/JT2M
    + .055 BD/JP2M + .048 BD3M    + .033 BD/LG3M + .048 BD/JT3M + .048 BD/JP3M
    + .075 BTIM    + .050 BT/LGIM + .075 BT/BSIM + .065 BT1M    + .043 BT/LG1M
    + .065 BT/JT1M + .065 BT/JP1M + .055 BT2M    + .038 BT/LG2M + .055 BT/JT2M
    + .055 BT/JP2M + .065 OG1M    + .043 OG/LG1M + .065 OG/JT1M + .065 OG/JP1M
    + .055 OG2M    + .038 OG/LG2M + .055 OG/JT2M + .055 OG/JP2M + .048 OG3M
    + .033 OG/LG3M + .048 OG/JT3M + .048 OG/JP3M
!
    +    0 BDIT    +    0 BD/LGIT +    0 BD/BSIT +    0 BD1T    +    0 BD/LG1T
    +    0 BD/JT1T +    0 BD/JP1T +    0 BD2T    +    0 BD/LG2T +    0 BD/JT2T
    +    0 BD/JP2T +    0 BD3T    +    0 BD/LG3T +    0 BD/JT3T +    0 BD/JP3T
    +    0 BTIT    +    0 BT/LGIT +    0 BT/BSIT +    0 BT/LG1T +    0 BT/JT1T
    +    0 BT/JP1T +    0 BT2T    +    0 BT/LG2T +    0 BT/JT2T +    0 BT/JP2T
    +    0 OG1T    +    0 OG/LG1T +    0 OG/JT1T +    0 OG/JP1T +    0 OG2T
    +    0 OG/LG2T +    0 OG/JT2T +    0 OG/JP2T +    0 OG3T    +    0 OG/LG3T
    +    0 OG/JT3T +    0 OG/JP3T
!
    + .038 AU/LG2  + .055 AU/JT2  + .033 AU/LG3  + .048 AU/JT3  + .350 BSI
    + .200 TMI     + .135 PQI     + .165 PDTI    + .165 PDTASI  + .200 PMI
    + .200 AUTCMI  + .150 FVVAI   + .150 FVA/BSI + .120 FVVA1   + .100 FVVA2
    + .085 FVVA3   + .150 FNVAI   + .120 FNVA1   + .100 FNVA2   + .085 FNVA3
    + .150 FVOGI   + .130 FVOG1   + .110 FVOG2   + .095 FVOG3   + .250 FVSGI
    + .220 FVSG1   + .190 FVSG2   + .160 FVSG3   + .150 ENVAI   + .120 ENVA1
    + .100 ENVA2   + .085 ENVA3   + .250 ENMSI   + .250 ENSGI   + .100 BRGI
    + .100 LZI     -      AMMON   =    0
!
!*****************************************************************************
!
!  Engrais--Super 45 (Tonne/ha)
!
!*****************************************************************************
!
 SUP45)
      .110 BDIH    + .110 BD/LGIH + .110 BD/BSIH + .105 BD1H    + .105 BD/LG1H
    + .105 BD/JT1H + .105 BD/JP1H + .105 BD2H    + .105 BD/LG2H + .105 BD/JT2H
    + .105 BD/JP2H + .100 BD3H    + .100 BD/LG3H + .100 BD/JT3H + .100 BD/JP3H
    + .110 BTIH    + .110 BT/LGIH + .110 BT/BSIH + .105 BT1H    + .105 BT/LG1H
    + .105 BT/JT1H + .105 BT/JP1H + .105 BT2H    + .105 BT/LG2H + .105 BT/JT2H
    + .105 BT/JP2H + .105 OG1H    + .105 OG/LG1H + .105 OG/JT1H + .105 OG/JP1H
    + .105 OG2H    + .105 OG/LG2H + .105 OG/JT2H + .105 OG/JP2H + .100 OG3H
    + .100 OG/LG3H + .100 OG/JT3H + .100 OG/JP3H
!
    + .055 BDIM    + .055 BD/LGIM + .055 BD/BSIM + .053 BD1M    + .053 BD/LG1M
    + .053 BD/JT1M + .053 BD/JP1M + .053 BD2M    + .053 BD/LG2M + .053 BD/JT2M
    + .053 BD/JP2M + .050 BD3M    + .050 BD/LG3M + .050 BD/JT3M + .050 BD/JP3M
    + .055 BTIM    + .055 BT/LGIM + .055 BT/BSIM + .053 BT1M    + .053 BT/LG1M
    + .053 BT/JT1M + .053 BT/JP1M + .053 BT2M    + .053 BT/LG2M + .053 BT/JT2M
    + .053 BT/JP2M + .053 OG1M    + .053 OG/LG1M + .053 OG/JT1M + .053 OG/JP1M
    + .053 OG2M    + .053 OG/LG2M + .053 OG/JT2M + .053 OG/JP2M + .050 OG3M
    + .050 OG/LG3M + .050 OG/JT3M + .050 OG/JP3M
!
```

```
    +    0 BDIT    +    0 BD/LGIT +    0 BD/BSIT +    0 BD1T    +    0 BD/LG1T
    +    0 BD/JT1T +    0 BD/JP1T +    0 BD2T    +    0 BD/LG2T +    0 BD/JT2T
    +    0 BD/JP2T +    0 BD3T    +    0 BD/LG3T +    0 BD/JT3T +    0 BD/JP3T
    +    0 BTIT    +    0 BT/LGIT +    0 BT/BSIT +    0 BT1T    +    0 BT/LG1T
    +    0 BT/JT1T +    0 BT/JP1T +    0 BT2T    +    0 BT/LG2T +    0 BT/JT2T
    +    0 BT/JP2T +    0 OG1T    +    0 OG/LG1T +    0 OG/JT1T +    0 OG/JP1T
    +    0 OG2T    +    0 OG/LG2T +    0 OG/JT2T +    0 OG/JP2T +    0 OG3T
    +    0 OG/LG3T +    0 OG/JT3T +    0 OG/JP3T
!
    + .053 AU/LG2  + .053 AU/JT2  + .050 AU/LG3  + .050 AU/JT3  + .150 BSI
    + .110 FVI     + .100 FV1     + .110 FV/BSI  + .175 TMI     + .115 PQI
    + .115 PDTI    + .115 PDTASI  + .175 PMI     + .175 AUTCMI  + .110 FVVAI
    + .110 FVA/BSI + .100 FVVA1   + .100 FVVA2   + .095 FVVA3   + .110 FNVAI
    + .100 FNVA1   + .100 FNVA2   + .095 FNVA3   + .110 FVOGI   + .105 FVOG1
    + .105 FVOG2   + .100 FVOG3   + .125 FVSGI   + .120 FVSG1   + .115 FVSG2
    + .110 FVSG3   + .110 ENVAI   + .100 ENVA1   + .100 ENVA2   + .095 ENVA3
    + .125 ENMSI   + .125 ENSGI   + .125 BRGI    + .150 LZI     -      SP45
    =    0
!
!*****************************************************************************
!
!  Engrais--Potasse (Tonne/ha)
!
!*****************************************************************************
!
 POTASSE)
      .100 BSI     + .100 TMI     + .100 PQI     + .100 PDTI    + .100 PDTASI
    + .100 PMI     + .100 AUTCMI  -      POTASS  =    0
!
!*****************************************************************************
!
!  Desherbant
!
!*****************************************************************************
!
 DESHERB)
      .020 BDIH    + .015 BD/LGIH + .015 BD/BSIH + .012 BD1H    + .012 BD/LG1H
    + .012 BD/JT1H + .015 BD/JP1H + .012 BD2H    + .012 BD/LG2H + .012 BD/JT2H
    + .015 BD/JP2H + .010 BD3H    + .010 BD/LG3H + .010 BD/JT3H + .012 BD/JP3H
    + .020 BTIH    + .015 BT/LGIH + .015 BT/BSIH + .012 BT1H    + .012 BT/LG1H
    + .012 BT/JT1H + .015 BT/JP1H + .012 BT2H    + .012 BT/LG2H + .012 BT/JT2H
    + .015 BT/JP2H + .009 OG1H    + .009 OG/LG1H + .009 OG/JT1H + .012 OG/JP1H
    + .009 OG2H    + .009 OG/LG2H + .009 OG/JT2H + .012 OG/JP2H + .007 OG3H
    + .007 OG/LG3H + .007 OG/JT3H + .009 OG/JP3H
!
    + .020 BDIM    + .015 BD/LGIM + .015 BD/BSIM + .012 BD1M    + .012 BD/LG1M
    + .012 BD/JT1M + .015 BD/JP1M + .012 BD2M    + .012 BD/LG2M + .012 BD/JT2M
    + .015 BD/JP2M + .010 BD3M    + .010 BD/LG3M + .010 BD/JT3M + .012 BD/JP3M
    + .020 BTIM    + .015 BT/LGIM + .015 BT/BSIM + .012 BT1M    + .012 BT/LG1M
    + .012 BT/JT1M + .015 BT/JP1M + .012 BT2M    + .012 BT/LG2M + .012 BT/JT2M
    + .015 BT/JP2M + .009 OG1M    + .009 OG/LG1M + .009 OG/JT1M + .012 OG/JP1M
    + .009 OG2M    + .009 OG/LG2M + .009 OG/JT2M + .012 OG/JP2M + .007 OG3M
    + .007 OG/LG3M + .007 OG/JT3M + .009 OG/JP3M
!
```

```
    + .020 BDIT    + .015 BD/LGIT + .015 BD/BSIT + .012 BD1T    + .012 BD/LG1T
    + .012 BD/JT1T + .015 BD/JP1T + .012 BD2T    + .012 BD/LG2T + .012 BD/JT2T
    + .015 BD/JP2T + .010 BD3T    + .010 BD/LG3T + .010 BD/JT3T + .012 BD/JP3T
    + .020 BTIT    + .015 BT/LGIT + .015 BT/BSIT + .012 BT1T    + .012 BT/LG1T
    + .012 BT/JT1T + .015 BT/JP1T + .012 BT2T    + .012 BT/LG2T + .012 BT/JT2T
    + .015 BT/JP2T + .009 OG1T    + .009 OG/LG1T + .009 OG/JT1T + .012 OG/JP1T
    + .009 OG2T    + .009 OG/LG2T + .009 OG/JT2T + .012 OG/JP2T + .007 OG3T
    + .007 OG/LG3T + .007 OG/JT3T + .009 OG/JP3T
!
    + .009 AU/LG2  + .009 AU/JT2  + .009 AU/LG3  + .009 AU/JT3  + .095 BSI
    + .000 FVI     + .000 FV1     + .000 FV/BSI  + .080 TMI     + .115 PQI
    + .120 PDTI    + .120 PDTASI  + .080 PMI     + .100 AUTCMI  -      DESHERB
    =    0
!
!*****************************************************************************
!
!  Utilisation de l'Eau
!
!*****************************************************************************
!
 EAU1)
       2.0 BDIH    +  2.0 BD/LGIH +  2.0 BD/BSIH +  2.0 BTIH    +  2.0 BT/LGIH
    +  2.0 BT/BSIH +  2.0 BDIM    +  2.0 BD/LGIM +  2.0 BD/BSIM +  2.0 BTIM
    +  2.0 BT/LGIM +  2.0 BT/BSIM +  2.0 BDIT    +  2.0 BD/LGIT +  2.0 BD/BSIT
    +  2.0 BTIT    +  2.0 BT/LGIT +  2.0 BT/BSIT +  1.5 FVI     +  1.5 FV/BSI
    +  4.5 BSI     +  7.5 TMI     +  7.5 PQI     +  4.0 PDTI    +  7.5 PMI
    +  7.5 AUTCMI  +  2.0 FVVAI   +  2.0 FVA/BSI +  2.0 FVOGI   +  6.0 FVSGI
    +  2.0 FNVAI   +  2.0 ENVAI   +  8.0 ENMSI   +  6.0 ENSGI   +  4.0 BRGI
    +  8.0 LZI     -      EAU1                                            <= 0
!
 EAU2)                4.0 PDTASI                                 -      EAU2
                                                                         <= 0
!
!*****************************************************************************
!
!  Credit Institionnel et Noninstitutionnel
!
!*****************************************************************************
!
 CREDIT)
    300 SEMBD   +   300 SEMBT   +   200 SEMOG   +   700 SEMFV   +  3500 SEMBS
 +  150 TMI     + 10000 SEMPQ   +   120 SEMPDT  +   250 PMI     +   200 AUTCMI
 +  250 SEMVT   +   150 SEMFN   +   200 SEMEN   +    25 EAU1    +    25 EAU2
 +  118 AMMON   +   110 SP45    +   300 POTASS  +  3000 SALAIR1 +  3000 PMHOMM1
 + 3000 PMFEMM1 +  3000 SALAIR2 +  3000 PMHOMM2 +  3000 PMFEMM2 +  3000 SALAIR3
 + 3000 PMHOMM3 +  3000 PMFEMM3 +  3000 SALAIR4 +  3000 PMHOMM4 +  3000 PMFEMM4
 + 3000 SALAIR5 +  3000 PMHOMM5 +  3000 PMFEMM5 +  7000 TRACTN  + 17000 MOISS
 + 7000 MECHFN3 +  7000 MECHFV1 +  7000 MECHFV2 +  7000 MECHFV3 +  7000 MECHFV4
 + 7000 MECHFV5 + 12000 PRESS3  +  1000 TRANSPT +  8000 BSTRAIT +   150 CONCTR
 + 1000 DESHERB -  1000 CREDIN  -  1000 CREDNIN                 =     0
!
 END
 LEAVE
```

Annex B

Base Model Optimal Solution

OBJECTIVE FUNCTION VALUE

1) 198088300.

VARIABLE	VALUE	REDUCED COST
PRODBD	443301.800000	.000000
PRODBT	110000.000000	.000000
PRODOG	126045.000000	.000000
PRODAU	31900.000000	.000000
PRODFV	57000.000000	.000000
PRODTM	66586.000000	.000000
PRODPQ	53843.400000	.000000
PRODPDT	59474.300000	.000000
PRODPM	8399.300000	.000000
PRODACM	63375.000000	.000000
PAILLE2	75609.020000	.000000
LAITBC	248625.000000	.000000
VIANDBC	37592.100000	.000000
VIANDOV	37172.410000	.000000
LAINE	3597.330000	.000000
SEMBD	40827.370000	.000000
SEMBT	6960.000000	.000000
SEMOG	14005.000000	.000000
SEMFV	5415.000000	.000000
TMI	3380.000000	.000000
SEMPQ	9.126000	.000000
SEMPDT	15122.500000	.000000
PMI	1183.000000	.000000
AUTCMI	4225.000000	.000000
SEMVT	3262.012000	.000000
SEMEN	3586.250000	.000000
EAU1	150928.500000	.000000
EAU2	10000.000000	.000000
AMMON	60179.520000	.000000
SP45	62333.880000	.000000
POTASS	1940.000000	.000000
PMHOMM1	678.400000	.000000
PMFEMM1	20.250000	.000000
PMHOMM2	1024.000000	.000000
PMFEMM2	30.150000	.000000
SALAIR3	2180.493000	.000000
PMHOMM3	1024.000000	.000000
PMFEMM3	30.600000	.000000
SALAIR4	261.506700	.000000
PMHOMM4	691.200000	.000000
PMFEMM4	20.250000	.000000
PMHOMM5	678.400000	.000000
PMFEMM5	20.250000	.000000

TRACTN	4705.109000	.000000
MOISS	782.903100	.000000
MECHFV3	46.964200	.000000
MECHFV4	47.823310	.000000
MECHFV5	17.297200	.000000
PRESS3	803.918500	.000000
TRANSPT	4265.638000	.000000
CONCTR	139230.000000	.000000
DESHERB	8595.212000	.000000
CREDIN	154977.900000	.000000
SUPBD	355020.600000	.000000
SUPBDH	355020.600000	.000000
SUPBT	58000.000000	.000000
SUPBTH	58000.000000	.000000
SUPOG	140050.000000	.000000
SUPOGT	140050.000000	.000000
BD2H	208902.300000	.000000
BD/LG2H	3061.717000	.000000
BD/JT2H	116606.600000	.000000
BD/JP2H	26450.000000	.000000
BT1H	1000.000000	.000000
BT/LG1H	57000.000000	.000000
OG/JP3T	140050.000000	.000000
SUPAU	29000.000000	.000000
AU/LG2	29000.000000	.000000
SUPFV	57000.000000	.000000
FV1	57000.000000	.000000
SUPTM	3380.000000	.000000
SUPPQ	4563.000000	.000000
PQI	4563.000000	.000000
SUPPDT	6049.000000	.000000
PDTI	3549.000000	.000000
PDTASI	2500.000000	.000000
SUPPM	1183.000000	.000000
SUPACM	4225.000000	.000000
SUPFVT	45972.750000	.000000
FVVA2	811.716900	.000000
FVOG2	19075.590000	.000000
FVSG2	26085.440000	.000000
SUPEN	37350.000000	.000000
ENSGI	6100.000000	.000000
ENVA2	31250.000000	.000000
SUPJT	116606.600000	.000000
JT2	116606.600000	.000000
SUPPAT	166500.000000	.000000
JP2	26450.000000	.000000
JP3	140050.000000	.000000
CULTMAR	16900.000000	.000000
ARBOCULT	82900.000000	.000000
PATUR	96100.000000	.000000
PRDBDH	443301.800000	.000000
PRDBTH	110000.000000	.000000
PRDOGT	126045.000000	.000000

PRDFVVA3	12175.750000	.000000
PRDFVOG2	324285.100000	.000000
PRDFVSG4	260854.400000	.000000
PRDFVSG5	391281.600000	.000000
PRDPAT1	105115.000000	.000000
PRDPAT2	268040.000000	.000000
PRDPAT3	268040.000000	.000000
PRDPAT4	176930.000000	.000000
PRDENVA3	468750.000000	.000000
PRDENSG4	152500.000000	.000000
PRDENSG5	213500.000000	.000000
PRDPAL4	1004898.000000	.000000
PDPAL4H	790539.100000	.000000
PDPAL4M	40600.000000	.000000
PDPAL4T	154055.000000	.000000
CFVVA3	12175.750000	.000000
CFVOG2	324285.100000	.000000
CFVSG4	260854.400000	.000000
CFVSG5	391281.600000	.000000
CFVPAT1	105115.000000	.000000
CFVPAT2	268040.000000	.000000
CFVPAT3	268040.000000	.000000
CFVPAT4	176930.000000	.000000
CENVA3	468750.000000	.000000
TSG51	350750.000000	.000000
CENSG1	246475.500000	.000000
TSG12	69199.460000	.000000
CENSG2	62279.510000	.000000
TSG45	152500.000000	.000000
TPAL51	665095.400000	.000000
CFNPAL1	145826.200000	.000000
TPAL12	477380.300000	.000000
CLTPAL1	21936.100000	.000000
CFNPAL2	188111.000000	.000000
TPAL23	161433.700000	.000000
CLTPAL2	37905.200000	.000000
CFNPAL3	118685.500000	.000000
CLTPAL3	37905.200000	.000000
CFNPAL4	125202.400000	.000000
TPAL45	857759.500000	.000000
CLTPAL4	21936.100000	.000000
CFNPAL5	144995.200000	.000000
CLTPAL5	21936.100000	.000000
BOVC	198900.000000	.000000
OVIN	1199110.000000	.000000
SEMBDH	40827.370000	.000000
SEMBTH	6960.000000	.000000
SEMOGT	14005.000000	.000000
SEMAU	3335.000000	.000000
PREP1	1592.964000	.000000
EPAND1	454.876300	.000000
SEMIS1	3446.511000	.000000
DESHER1	300.000000	.000000

MOISS1	757.965000	.000000
TRAVFV1	756.477800	.000000
FMHOMM1	904.283400	.000000
FMFEMM1	972.420000	.000000
PREP2	89.924900	.000000
EPAND2	397.426300	.000000
DESHER2	3514.437000	.000000
MOISS2	375.000000	.000000
FMHOMM2	1740.608000	.000000
PREP3	133.035800	.000000
EPAND3	78.544910	.000000
SEMIS3	1281.646000	.000000
DESHER3	6634.467000	.000000
TRAVFN3	20097.960000	.000000
TRAVEN3	100.000000	.000000
FMHOMM3	2277.000000	.000000
FMFEMM3	1484.220000	.000000
EPAND4	65.768510	.000000
DESHER4	3068.195000	.000000
MOISS4	9199.963000	.000000
TRAVEN4	36.600000	.000000
FMHOMM4	1518.000000	.000000
FMFEMM4	972.420000	.000000
PREP5	2734.901000	.000000
MOISS5	6033.503000	.000000
TRAVFV5	2038.574000	.000000
FMHOMM5	1518.000000	.000000
FMFEMM5	972.420000	.000000
FMHOMME	37950.000000	.000000
FMFEMME	25590.000000	.000000
PMHOMME	12800.000000	.000000
PMFEMME	450.000000	.000000
MECHEN3	50.000000	.000000
MECHEN4	18.300000	.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
SUPAU)	.000000	28.745540
SUPFV)	.000000	-215.082900
SUPFN)	.000000	57.290510
IRRIG1)	.000000	393.012000
IRRIG2)	.000000	1159.325000
TERREPO)	.000000	131.228700
TERREPM)	.000000	56.376960
TERREPF)	.000000	33.297420
PATURAGE)	.000000	21.057310
JACH)	.000000	-3.195189
CULTMARI)	.000000	607.354000
LEGUME)	.000000	215.082900
AUTCERLS)	.000000	-28.745540
ARBOCULT)	.000000	-33.297420
FIXTM)	.000000	913.996500

FIXPQ)	.000000	1013.105000
FIXPDT)	.000000	1349.224000
FIXPM)	.000000	1006.770000
FIXAUT)	.000000	760.870600
CERLEGMI)	.000000	30.172370
ASSOLBS1)	.000000	-135.174900
ASSOLBS2)	.000000	90.975270
CERLEG1)	.000000	39.734790
CERJCT1)	.000000	153.908700
CERJCP1)	.000000	-3.239990
CERLEG2)	.000000	22.960410
CERJCT2)	.000000	79.056960
CERJCP2)	.000000	-3.240003
CERLEG3)	.000000	26.071040
CERJCT3)	.000000	55.977420
CERJCP3)	.000000	-10.075270
PRODBD)	.000000	185.000000
PRODBT)	.000000	170.000000
PRODOG)	.000000	120.000000
PRDBDH)	.000000	185.000000
PRDBTH)	.000000	170.000000
PRDOGH)	.000000	120.000000
PRDBDM)	.000000	187.324600
PRDBTM)	.000000	175.550800
PRDOGM)	.000000	120.000000
PRDBDT)	.000000	202.007600
PRDBTT)	.000000	188.371500
PRDOGT)	.000000	120.000000
PRODAU)	.000000	110.000000
PRODFV)	.000000	530.000000
PRODBS)	.000000	28.355260
PRODTM)	.000000	100.000000
PRODPQ)	.000000	150.000000
PRODPDT)	.000000	220.000000
PRODPM)	.000000	300.000000
PRODACM)	.000000	125.000000
RFVVA1)	.000000	11.797010
RFVVA2)	.000000	12.716400
RFVVA3)	.000000	11.210970
RFVVA4)	.000000	8.862952
RFVVA5)	.000000	10.199050
RFVOG1)	.000000	10.443650
RFVOG2)	.000000	11.554790
RFVOG3)	.000000	9.213536
RFVOG4)	.000000	6.647214
RFVOG5)	.000000	8.362187
RFVSG1)	.000000	11.676080
RFVSG2)	.000000	12.916630
RFVSG3)	.000000	10.304910
RFVSG4)	.000000	7.438549
RFVSG5)	.000000	9.352836
RFVBRG1)	.000000	7.294825

RFVBRG2)	.000000	7.966457
RFVBRG3)	.000000	12.614000
RFVBRG4)	.000000	5.064544
RFVBRG5)	.000000	6.075362
RFVLZ1)	.000000	34.740090
RFVLZ2)	.000000	12.340210
RFVLZ3)	.000000	10.074820
RFVLZ4)	.000000	7.438549
RFVLZ5)	.000000	9.149151
RFVPAT1)	.000000	12.580750
RFVPAT2)	.000000	13.785650
RFVPAT3)	.000000	11.418670
RFVPAT4)	.000000	8.546418
RFVPAT5)	.000000	10.373110
RENVA1)	.000000	12.965350
RENVA2)	.000000	14.036440
RENVA3)	.000000	12.176100
RENVA4)	.000000	13.529000
RENVA5)	.000000	11.668810
RENMS1)	.000000	15.929650
RENMS2)	.000000	17.699610
RENMS3)	.000000	13.419200
RENMS4)	.000000	14.545140
RENMS5)	.000000	14.336690
RENSG1)	.000000	13.072400
RENSG2)	.000000	14.524890
RENSG3)	.000000	11.385080
RENSG4)	.000000	10.588640
RENSG5)	.000000	11.765160
RFNVA1)	.000000	53.350000
RFNVA2)	.000000	55.000000
RFNVA3)	.000000	48.691110
RFNVA4)	.000000	50.197020
RFNVA5)	.000000	51.749500
RPAILL1)	.000000	7.082542
RPAILL2)	.000000	7.982542
RPAILL3)	.000000	8.910376
RPAILL4)	.000000	5.362734
RPAILL5)	.000000	6.209543
PRDPL4H)	.000000	5.469988
PRDPL4M)	.000000	5.469988
PRDPL4T)	.000000	5.469988
FVVA1)	.000000	-11.797010
FVVA2)	.000000	-12.716400
FVVA3)	.000000	-11.210970
FVVA4)	.000000	-8.862952
FVVA5)	.000000	-10.199050
FVOG1)	.000000	-10.443650
FVOG2)	.000000	-11.554790
FVOG3)	.000000	-9.213536
FVOG4)	.000000	-6.647214
FVOG5)	.000000	-8.362187
FVSG1)	.000000	-11.676080

FVSG2)	.000000	-12.916630
FVSG3)	.000000	-10.304910
FVSG4)	.000000	-7.438549
FVSG5)	.000000	-9.352836
FVBRG1)	.000000	-7.294825
FVBRG2)	.000000	-7.966457
FVBRG3)	.000000	-6.685662
FVBRG4)	.000000	-5.064544
FVBRG5)	.000000	-6.075362
FVLZ1)	.000000	-11.220110
FVLZ2)	.000000	-12.340210
FVLZ3)	.000000	-10.074820
FVLZ4)	.000000	-7.438549
FVLZ5)	.000000	-9.149151
FVPAT1)	.000000	-12.580750
FVPAT2)	.000000	-13.785650
FVPAT3)	.000000	-11.418670
FVPAT4)	.000000	-8.546418
FVPAT5)	.000000	-10.373110
ENVA1)	.000000	-12.965350
ENVA2)	.000000	-14.036440
ENVA3)	.000000	-12.176100
ENVA4)	.000000	-13.529000
ENVA5)	.000000	-11.668810
ENMS1)	.000000	-15.929650
ENMS2)	.000000	-17.699610
ENMS3)	.000000	-13.419200
ENMS4)	.000000	-12.903020
ENMS5)	.000000	-14.336690
ENSG1)	.000000	-13.072400
ENSG2)	.000000	-14.524890
ENSG3)	.000000	-11.385080
ENSG4)	.000000	-10.588640
ENSG5)	.000000	-11.765160
FNVA1)	.000000	-53.350000
FNVA2)	.000000	-55.000000
FNVA3)	.000000	-48.691110
FNVA4)	.000000	-50.197020
FNVA5)	.000000	-51.749500
FNPAL1)	.000000	-29.100000
FNPAL2)	.000000	-30.000000
FNPAL3)	.000000	-30.927830
FNPAL4)	.000000	-27.380190
FNPAL5)	.000000	-28.227000
UF1)	.000000	-.045597
MS1)	.000000	-.012820
LITIER1)	.000000	-29.100000
UF2)	.000000	-.057643
MS2)	.000000	-.008360
LITIER2)	.000000	-30.000000
UF3)	.000000	-.023009
MS3)	.000000	-.025248
LITIER3)	.000000	-30.927830

MS4)	.000000	-.031653
LITIER4)	.000000	-27.380190
UF5)	.000000	-.020369
MS5)	.000000	-.023331
LITIER5)	.000000	-28.227000
CONCTR)	.000000	162.000000
BOVPMAX)	.000000	307.407800
BOVCMAX)	.000000	236.901800
OVINMAX)	.000000	32.691910
LAITBP)	.000000	200.000000
LAITBC)	.000000	200.000000
WOOLOV)	.000000	1700.000000
VIANDBP)	.000000	1400.000000
VIANDBC)	.000000	1400.000000
VIANDOV)	.000000	1800.000000
SEMBD)	.000000	-324.000000
SEMBT)	.000000	-324.000000
SEMOG)	.000000	-216.000000
SEMBDH)	.000000	-324.000000
SEMBTH)	.000000	-324.000000
SEMOGH)	.000000	-216.000000
SEMBDM)	.000000	-324.000000
SEMBTM)	.000000	-324.000000
SEMOGM)	.000000	-214.333700
SEMBDT)	.000000	-324.000000
SEMBTT)	.000000	-324.000000
SEMOGT)	.000000	-216.000000
SEMCFV)	.000000	-756.000000
SEMCBS)	.000000	-3780.000000
SEMCPQ)	.000000	-10800.000000
SEMCPT)	.000000	-129.600000
SEMVT)	.000000	-270.000000
SEMCEN)	.000000	-216.000000
SEMFN)	.000000	-162.000000
SALAR)	.000000	80.095420
TRAV3)	.000000	582.472900
TRAV4)	.000000	582.472900
TRAV5)	.000000	180.000000
FMHOMME)	.000000	373.049500
FMFEMME)	.000000	357.717200
PMHOMME)	.000000	-537.529200
PMFEMME)	.000000	-453.459200
FMHOMM3)	.000000	3320.095000
FMHOMM4)	.000000	3320.095000
FMHOMM5)	.000000	1026.000000
FMFEMM3)	.000000	3320.095000
FMFEMM4)	.000000	3320.095000
FMFEMM5)	.000000	1026.000000
PMHOMM1)	.000000	-3240.000000
PMHOMM2)	.000000	-3240.000000
PMHOMM3)	.000000	80.095440
PMHOMM4)	.000000	80.095440
PMHOMM5)	.000000	-2214.000000

PMFEMM1)	.000000	-3240.000000
PMFEMM2)	.000000	-3240.000000
PMFEMM3)	.000000	80.095440
PMFEMM4)	.000000	80.095440
PMFEMM5)	.000000	-2214.000000
MOPREP3)	.000000	.582473
MOPREP5)	.000000	.180000
MOEPAND3)	.000000	.582473
MOEPAND4)	.000000	.582473
MOSEMIS3)	.000000	.582473
MODESH3)	.000000	.582473
MODESH4)	.000000	.582473
MOMOIS4)	.000000	.582473
MOMOIS5)	.000000	.180000
TRACTION)	.000000	7.560000
MOFURU3)	.000000	.582473
FOUROU3)	.000000	7.560000
MOPRESS3)	.000000	.582473
PRESS3)	.000000	12.960000
RECFV3)	.000000	.180000
RECFV4)	.000000	.180000
RECFV5)	.000000	.180000
MORECEN3)	.000000	.582473
MORECEN4)	.000000	.582473
RECEN3)	.000000	25.826920
MECHEN3)	.000000	25826.920000
BSTRAIT)	.000000	8.640000
MOISS)	.000000	18.360000
TRANS)	.000000	1.080000
AMMON)	.000000	127.440000
SUP45)	.000000	118.800000
POTASSE)	.000000	324.000000
DESHERB)	.000000	1080.000000
EAU1)	.000000	27.000000
EAU2)	.000000	27.000000
CREDIT)	.000000	.080000

NO. ITERATIONS= 425

Annex C

Right-Hand-Side Ranges, Base Model Optimal Solution

RANGES IN WHICH THE BASIS IS UNCHANGED:

OBJ COEFFICIENT RANGES

VARIABLE	CURRENT COEF	ALLOWABLE INCREASE	ALLOWABLE DECREASE
PRODBD	185.000000	2.973757	.930879
PRODBT	170.000000	.861645	2.623147
PRODOG	120.000000	1.666275	11.407740
PRODAU	110.000000	87.175110	55.421550
PRODFV	530.000000	256.416000	403.006400
PRODBS	27.000000	1.355265	INFINITY
PRODTM	100.000000	INFINITY	154.150800
PRODPQ	150.000000	INFINITY	190.632100
PRODPDT	220.000000	INFINITY	134.805200
PRODPM	300.000000	INFINITY	1222.040000
PRODACM	125.000000	INFINITY	161.961100
FOIN1	50.000000	3.350002	INFINITY
FOIN2	55.000000	15.783810	1.859394
FOIN5	50.000000	1.749504	INFINITY
PAILLE1	25.000000	4.100000	INFINITY
PAILLE2	30.000000	1.194308	.342088
PAILLE5	20.000000	8.227001	INFINITY
LAITBP	200.000000	INFINITY	175.661600
LAITBC	200.000000	INFINITY	189.521400
VIANDBP	1400.000000	INFINITY	1280.866000
VIANDBC	1400.000000	INFINITY	1253.448000
VIANDOV	1800.000000	INFINITY	1054.578000
LAINE	1700.000000	INFINITY	1700.000000
SEMBD	-300.000000	44.923980	5.261494
SEMBT	-300.000000	12.418920	37.185880
SEMOG	-200.000000	158.305400	102.669700
SEMFV	-700.000000	12820.800000	20150.310000
SEMBS	-3500.000000	4273.601000	INFINITY
TMI	-150.000000	INFINITY	3036.770000
SEMPQ	-10000.000000	INFINITY	1124730.000000
SEMPDT	-120.000000	INFINITY	463.729800
PMI	-250.000000	INFINITY	8676.485000
AUTCMI	-200.000000	INFINITY	2429.416000
SEMVT	-250.000000	52.976460	105.945600
SEMFN	-150.000000	545.624000	2216.865000
SEMEN	-200.000000	4460.853000	393.553100
EAU1	-25.000000	27.000000	6.410402
EAU2	-25.000000	27.000000	289.831100
AMMON	-118.000000	3.941257	5.500652
SP45	-110.000000	3.741256	5.762588
POTASS	-300.000000	641.040200	6073.540000
SALAIR1	-3000.000000	3320.095000	INFINITY

PMHOMM1	-3000.000000	INFINITY	INFINITY
PMFEMM1	-3000.000000	INFINITY	INFINITY
SALAIR2	-3000.000000	3320.095000	INFINITY
PMHOMM2	-3000.000000	INFINITY	INFINITY
PMFEMM2	-3000.000000	INFINITY	INFINITY
SALAIR3	-3000.000000	17064.500000	86.093570
PMHOMM3	-3000.000000	INFINITY	INFINITY
PMFEMM3	-3000.000000	INFINITY	INFINITY
SALAIR4	-3000.000000	2286.009000	1149.636000
PMHOMM4	-3000.000000	INFINITY	INFINITY
PMFEMM4	-3000.000000	INFINITY	INFINITY
SALAIR5	-3000.000000	2294.095000	INFINITY
PMHOMM5	-3000.000000	INFINITY	INFINITY
PMFEMM5	-3000.000000	INFINITY	INFINITY
TRACTN	-7000.000000	1201.240000	183.355100
MOISS	-17000.000000	8023.329000	550.065200
MECHFN3	-7000.000000	19096.840000	INFINITY
MECHFV1	-7000.000000	7560.000000	INFINITY
MECHFV2	-7000.000000	7560.000000	INFINITY
MECHFV3	-7000.000000	2463.049000	5245.358000
MECHFV4	-7000.000000	7560.000000	6397.159000
MECHFV5	-7000.000000	7560.000000	4166.067000
PRESS3	-12000.000000	12960.000000	390.268100
TRANSPT	-1000.000000	665.705700	126.056600
BSTRAIT	-8000.000000	32052.010000	INFINITY
CONCTR	-150.000000	162.000000	307.407800
DESHERB	-1000.000000	735.472000	50.422640
CREDIN	-80.000000	30.277660	3.783717
CREDNIN	-150.000000	70.000000	INFINITY
SUPBD	.000000	5.166258	.605072
SUPBDH	.000000	5.166258	.605072
SUPBDM	.000000	3.393894	28.284590
SUPBDT	.000000	21.939820	35.564790
SUPBT	.000000	1.428176	4.276376
SUPBTH	.000000	2.929592	6.817957
SUPBTM	.000000	2.786685	7.725069
SUPBTT	.000000	25.536330	7.489437
SUPOG	.000000	15.830540	10.266970
SUPOGH	.000000	6.205801	INFINITY
SUPOGM	.000000	.166627	174.305200
SUPOGT	.000000	15.830540	.166627
BDIH	.000000	69.026630	INFINITY
BD/LGIH	.000000	31.927010	INFINITY
BD/BSIH	.000000	19.427050	INFINITY
BD1H	.000000	18.416470	INFINITY
BD/LG1H	.000000	24.666480	INFINITY
BD/JT1H	.000000	56.344410	INFINITY
BD/JP1H	.000000	18.416480	INFINITY
BD2H	.000000	3.194622	.302536
BD/LG2H	.000000	3.045079	3.107596
BD/JT2H	.000000	.605072	1.229257
BD/JP2H	.000000	3.195189	1.046136
BD3H	.000000	49.257140	INFINITY

BD/LG3H	.000000	62.254970	INFINITY
BD/JT3H	.000000	63.101310	INFINITY
BD/JP3H	.000000	41.341860	INFINITY
BTIH	.000000	49.599610	INFINITY
BT/LGIH	.000000	177.850100	.965633
BT/BSIH	.000000	.858341	10.944610
BT1H	.000000	32.052010	3.408979
BT/LG1H	.000000	6.817957	12.888040
BT/JT1H	.000000	13.982890	INFINITY
BT/JP1H	.000000	63.739720	11.067090
BT2H	.000000	17.594000	INFINITY
BT/LG2H	.000000	19.094020	INFINITY
BT/JT2H	.000000	7.496462	INFINITY
BT/JP2H	.000000	17.594010	INFINITY
OG1H	.000000	86.491690	INFINITY
OG/LG1H	.000000	102.491700	INFINITY
OG/JT1H	.000000	194.801800	INFINITY
OG/JP1H	.000000	86.491700	INFINITY
OG2H	.000000	30.033690	INFINITY
OG/LG2H	.000000	30.533700	INFINITY
OG/JT2H	.000000	75.716640	INFINITY
OG/JP2H	.000000	30.033690	INFINITY
OG3H	.000000	14.121070	INFINITY
OG/LG3H	.000000	24.368900	INFINITY
OG/JT3H	.000000	48.383470	INFINITY
OG/JP3H	.000000	6.205801	INFINITY
BDIM	.000000	76.334340	INFINITY
BD/LGIM	.000000	41.725290	INFINITY
BD/BSIM	.000000	26.734750	INFINITY
BD1M	.000000	30.958090	INFINITY
BD/LG1M	.000000	39.790500	INFINITY
BD/JT1M	.000000	67.374990	INFINITY
BD/JP1M	.000000	30.958100	INFINITY
BD2M	.000000	1.046142	INFINITY
BD/LG2M	.000000	3.107596	INFINITY
BD/JT2M	.000000	3.393894	1.512236
BD/JP2M	.000000	1.046136	INFINITY
BD3M	.000000	43.240200	INFINITY
BD/LG3M	.000000	58.033410	INFINITY
BD/JT3M	.000000	56.503220	INFINITY
BD/JP3M	.000000	35.324930	INFINITY
BTIM	.000000	49.599560	INFINITY
BT/LGIM	.000000	.965633	INFINITY
BT/BSIM	.000000	17.762550	.858341
BT1M	.000000	11.067080	INFINITY
BT/LG1M	.000000	12.888040	INFINITY
BT/JT1M	.000000	20.255580	INFINITY
BT/JP1M	.000000	11.067090	INFINITY
BT2M	.000000	14.578660	INFINITY
BT/LG2M	.000000	17.817500	INFINITY
BT/JT2M	.000000	1.428176	INFINITY
BT/JP2M	.000000	14.578650	INFINITY
OG1M	.000000	87.204540	INFINITY

OG/LG1M	.000000	106.135700	INFINITY
OG/JT1M	.000000	195.514700	INFINITY
OG/JP1M	.000000	87.204560	INFINITY
OG2M	.000000	26.145780	INFINITY
OG/LG2M	.000000	28.939720	INFINITY
OG/JT2M	.000000	71.712230	INFINITY
OG/JP2M	.000000	26.145780	INFINITY
OG3M	.000000	7.915268	INFINITY
OG/LG3M	.000000	20.074700	INFINITY
OG/JT3M	.000000	42.119420	INFINITY
OG/JP3M	.000000	.166627	7.915268
BDIT	.000000	83.510210	INFINITY
BD/LGIT	.000000	47.680300	INFINITY
BD/BSIT	.000000	33.910610	INFINITY
BD1T	.000000	61.857670	INFINITY
BD/LG1T	.000000	71.291330	INFINITY
BD/JT1T	.000000	88.730620	INFINITY
BD/JP1T	.000000	61.857680	INFINITY
BD2T	.000000	7.653474	INFINITY
BD/LG2T	.000000	10.413120	INFINITY
BD/JT2T	.000000	21.939820	11.753540
BD/JP2T	.000000	7.653468	INFINITY
BD3T	.000000	38.317810	INFINITY
BD/LG3T	.000000	54.288460	INFINITY
BD/JT3T	.000000	47.910060	INFINITY
BD/JP3T	.000000	30.402530	INFINITY
BTIT	.000000	60.544190	INFINITY
BT/LGIT	.000000	9.967957	INFINITY
BT/BSIT	.000000	10.944610	INFINITY
BT1T	.000000	44.771840	INFINITY
BT/LG1T	.000000	46.832340	INFINITY
BT/JT1T	.000000	43.062730	INFINITY
BT/JP1T	.000000	44.771850	INFINITY
BT2T	.000000	20.201840	INFINITY
BT/LG2T	.000000	24.325100	INFINITY
BT/JT2T	.000000	25.536330	4.276376
BT/JP2T	.000000	20.201840	INFINITY
OG1T	.000000	104.229000	INFINITY
OG/LG1T	.000000	125.963800	INFINITY
OG/JT1T	.000000	212.539100	INFINITY
OG/JP1T	.000000	104.229000	INFINITY
OG2T	.000000	32.005820	INFINITY
OG/LG2T	.000000	36.966220	INFINITY
OG/JT2T	.000000	77.572260	INFINITY
OG/JP2T	.000000	32.005810	INFINITY
OG3T	.000000	7.915270	INFINITY
OG/LG3T	.000000	21.986310	INFINITY
OG/JT3T	.000000	42.177680	INFINITY
OG/JP3T	.000000	15.830540	.166627
SUPAU	.000000	INFINITY	INFINITY
AU/LG2	.000000	20.074700	10.266970
AU/JT2	.000000	26.152530	INFINITY
AU/LG3	.000000	11.084310	20.074700

AU/JT3	.000000	10.266970	INFINITY
SUPFV	.000000	INFINITY	INFINITY
FVI	.000000	195.977800	INFINITY
FV/BSI	.000000	64.104010	100.751600
FV1	.000000	100.751600	64.104010
SUPBS	.000000	64.104010	INFINITY
BSI	.000000	64.104010	INFINITY
SUPTM	.000000	INFINITY	3036.770000
SUPPQ	.000000	INFINITY	2249.459000
PQI	.000000	INFINITY	2249.459000
SUPPDT	.000000	INFINITY	1159.325000
PDTI	.000000	INFINITY	2892.162000
PDTASI	.000000	INFINITY	1159.325000
SUPPM	.000000	INFINITY	8676.485000
SUPACM	.000000	INFINITY	2429.416000
SUPFVT	.000000	5.562528	11.124290
FVVAI	.000000	296.729400	INFINITY
FVA/BSI	.000000	100.751600	INFINITY
FVOGI	.000000	299.516800	INFINITY
FVSGI	.000000	236.222200	INFINITY
BRGI	.000000	177.850100	INFINITY
LZI	.000000	211.679700	INFINITY
FVVA1	.000000	11.825260	INFINITY
FVOG1	.000000	26.862560	INFINITY
FVSG1	.000000	7.121200	INFINITY
FVVA2	.000000	3.045079	8.868948
FVOG2	.000000	5.864403	6.728377
FVSG2	.000000	25.263420	5.340900
FVVA3	.000000	29.102040	INFINITY
FVOG3	.000000	35.193570	INFINITY
FVSG3	.000000	41.972210	INFINITY
SUPFN	.000000	57.290510	INFINITY
FNVAI	.000000	339.844300	INFINITY
FNVA1	.000000	41.267340	INFINITY
FNVA2	.000000	57.290510	11.084310
FNVA3	.000000	11.084310	INFINITY
SUPEN	.000000	289.955700	21.368010
ENMSI	.000000	82.105930	INFINITY
ENSGI	.000000	607.354000	21.368010
ENVAI	.000000	230.301100	INFINITY
ENVA1	.000000	6.817957	INFINITY
ENVA2	.000000	INFINITY	6.060407
ENVA3	.000000	36.244460	INFINITY
SUPJT	.000000	.605072	4.441494
JT1	.000000	13.982890	INFINITY
JT2	.000000	.605072	4.441494
JT3	.000000	10.266970	INFINITY
SUPPAT	.000000	3.195189	10.266970
JP1	.000000	63.739720	INFINITY
JP2	.000000	3.195189	INFINITY
JP3	.000000	INFINITY	10.266970
CULTMAR	.000000	INFINITY	607.354000
IRRSEC	.000000	261.783400	INFINITY

ARBOCULT	.000000	INFINITY	INFINITY
PATUR	.000000	INFINITY	21.057310
PRDBDH	.000000	2.973757	.930879
PRDBDM	.000000	2.324585	INFINITY
PRDBDT	.000000	17.007610	INFINITY
PRDBTH	.000000	.861645	2.623147
PRDBTM	.000000	5.550797	INFINITY
PRDBTT	.000000	18.371460	INFINITY
PRDOGH	.000000	5.910287	INFINITY
PRDOGM	.000000	.166627	871.525500
PRDOGT	.000000	17.589480	.185142
PRDFVVA1	.000000	INFINITY	INFINITY
PRDFVVA2	.000000	INFINITY	INFINITY
PRDFVVA3	.000000	.203005	1.357413
PRDFVVA4	.000000	INFINITY	INFINITY
PRDFVVA5	.000000	INFINITY	INFINITY
PRDFVOG1	.000000	INFINITY	INFINITY
PRDFVOG2	.000000	.344965	.395787
PRDFVOG3	.000000	INFINITY	INFINITY
PRDFVOG4	.000000	INFINITY	INFINITY
PRDFVOG5	.000000	INFINITY	INFINITY
PRDFVSG1	.000000	INFINITY	INFINITY
PRDFVSG2	.000000	INFINITY	INFINITY
PRDFVSG3	.000000	INFINITY	INFINITY
PRDFVSG4	.000000	2.526342	1.172812
PRDFVSG5	.000000	1.684228	.781875
PRDBRG1	.000000	INFINITY	INFINITY
PRDBRG2	.000000	5.928336	INFINITY
PRDBRG3	.000000	5.928336	INFINITY
PRDBRG4	.000000	INFINITY	INFINITY
PRDBRG5	.000000	INFINITY	INFINITY
PRDLUZ1	.000000	23.519970	INFINITY
PRDLUZ2	.000000	17.639980	INFINITY
PRDLUZ3	.000000	17.639980	INFINITY
PRDLUZ4	.000000	17.639980	INFINITY
PRDLUZ5	.000000	23.519970	INFINITY
PRDPAT1	.000000	5.325314	20.533940
PRDPAT2	.000000	1.996993	8.555806
PRDPAT3	.000000	1.996993	8.555806
PRDPAT4	.000000	3.195189	12.833710
PRDPAT5	.000000	INFINITY	INFINITY
PRDENVA1	.000000	INFINITY	INFINITY
PRDENVA2	.000000	INFINITY	INFINITY
PRDENVA3	.000000	2.181746	2.754872
PRDENVA4	.000000	INFINITY	INFINITY
PRDENVA5	.000000	INFINITY	INFINITY
PRDENMS1	.000000	INFINITY	INFINITY
PRDENMS2	.000000	INFINITY	INFINITY
PRDENMS3	.000000	INFINITY	INFINITY
PRDENMS4	.000000	1.642118	INFINITY
PRDENMS5	.000000	INFINITY	INFINITY
PRDENSG1	.000000	INFINITY	INFINITY
PRDENSG2	.000000	INFINITY	INFINITY

PRDENSG3	.000000	INFINITY	INFINITY
PRDENSG4	.000000	24.294160	.854720
PRDENSG5	.000000	17.352970	.610514
PRDFNVA1	.000000	INFINITY	INFINITY
PRDFNVA2	.000000	INFINITY	INFINITY
PRDFNVA3	.000000	13.973300	7.917367
PRDFNVA4	.000000	INFINITY	INFINITY
PRDFNVA5	.000000	INFINITY	INFINITY
PRDPAL1	.000000	INFINITY	INFINITY
PRDPAL2	.000000	INFINITY	INFINITY
PRDPAL3	.000000	INFINITY	INFINITY
PRDPAL4	.000000	7.544150	.312215
PDPAL4H	.000000	3.088595	.318459
PDPAL4M	.000000	.138856	3.090027
PDPAL4T	.000000	13.712390	.151480
PRDPAL5	.000000	INFINITY	INFINITY
CFVVA1	.000000	INFINITY	11.797010
TFVVA12	.000000	11.797010	INFINITY
CFVVA2	.000000	INFINITY	12.716400
TFVVA23	.000000	12.716400	INFINITY
CFVVA3	.000000	.203005	1.357413
TFVVA34	.000000	11.210970	INFINITY
CFVVA4	.000000	INFINITY	8.862952
TFVVA45	.000000	8.862952	INFINITY
CFVVA5	.000000	INFINITY	10.199050
TFVVA51	.000000	10.199050	INFINITY
CFVOG1	.000000	INFINITY	10.443650
TFVOG12	.000000	10.443650	INFINITY
CFVOG2	.000000	.344965	.395787
TFVOG23	.000000	11.554790	INFINITY
CFVOG3	.000000	INFINITY	9.213536
TFVOG34	.000000	9.213536	INFINITY
CFVOG4	.000000	INFINITY	6.647214
TFVOG45	.000000	6.647214	INFINITY
CFVOG5	.000000	INFINITY	8.362187
TFVOG51	.000000	8.362187	INFINITY
CFVSG1	.000000	INFINITY	11.676080
TFVSG12	.000000	11.676080	INFINITY
CFVSG2	.000000	INFINITY	12.916630
TFVSG23	.000000	12.916630	INFINITY
CFVSG3	.000000	INFINITY	10.304910
TFVSG34	.000000	10.304910	INFINITY
CFVSG4	.000000	2.526342	1.172812
TFVSG45	.000000	7.438549	INFINITY
CFVSG5	.000000	1.684228	.781875
TFVSG51	.000000	9.352836	INFINITY
CFVBRG1	.000000	INFINITY	7.294825
TBRG12	.000000	7.294825	INFINITY
CFVBRG2	.000000	5.928336	7.966457
TBRG23	.000000	7.966457	INFINITY
CFVBRG3	.000000	5.928336	6.685662
TBRG34	.000000	6.685662	INFINITY
CFVBRG4	.000000	INFINITY	5.064544

TBRG45	.000000	5.064544	INFINITY
CFVBRG5	.000000	INFINITY	6.075362
TBRG51	.000000	6.075362	INFINITY
CFVLZ1	.000000	23.519970	11.220110
TLZ12	.000000	11.220110	INFINITY
CFVLZ2	.000000	17.639980	12.340210
TLZ23	.000000	12.340210	INFINITY
CFVLZ3	.000000	17.639980	10.074820
TLZ34	.000000	10.074820	INFINITY
CFVLZ4	.000000	17.639980	7.438549
TLZ45	.000000	7.438549	INFINITY
CFVLZ5	.000000	23.519970	9.149151
TLZ51	.000000	9.149151	INFINITY
CFVPAT1	.000000	5.325314	12.580750
TPAT12	.000000	12.580750	INFINITY
CFVPAT2	.000000	1.996993	8.555806
TPAT23	.000000	13.785650	INFINITY
CFVPAT3	.000000	1.996993	8.555806
TPAT34	.000000	11.418670	INFINITY
CFVPAT4	.000000	3.195189	8.546418
TPAT45	.000000	8.546418	INFINITY
CFVPAT5	.000000	INFINITY	10.373110
TPAT51	.000000	10.373110	INFINITY
TENVA51	.000000	3.363415	.595766
CENVA1	.000000	3.737128	.332550
TENVA12	.000000	.332550	INFINITY
CENVA2	.000000	.369500	1.860338
TENVA23	.000000	1.860338	INFINITY
CENVA3	.000000	1.860338	2.724366
TENVA34	.000000	2.724366	INFINITY
CENVA4	.000000	4.032984	INFINITY
TENVA45	.000000	3.027074	INFINITY
CENVA5	.000000	.595766	INFINITY
TMS51	.000000	.573531	2.173000
CENMS1	.000000	.128712	INFINITY
TMS12	.000000	.637257	.128712
CENMS2	.000000	.708063	.143013
TMS23	.000000	5.622337	INFINITY
CENMS3	.000000	6.247042	.516178
TMS34	.000000	.516178	INFINITY
CENMS4	.000000	3.723532	INFINITY
TMS45	.000000	.516178	3.723532
CENMS5	.000000	2.173000	INFINITY
TSG51	.000000	.884931	.371617
CENSG1	.000000	.520181	.095685
TSG12	.000000	.095685	.412908
CENSG2	.000000	.106317	.458787
TSG23	.000000	4.278317	INFINITY
CENSG3	.000000	4.753686	.796438
TSG34	.000000	.796438	INFINITY
CENSG4	.000000	2.517028	INFINITY
TSG45	.000000	.796438	.854720
CENSG5	.000000	1.436490	INFINITY

TFNVA51	.000000	6.705163	1.749504
CFNVA1	.000000	14.346910	INFINITY
TFNVA12	.000000	6.912539	1.803612
CFNVA2	.000000	12.402230	INFINITY
TFNVA23	.000000	6.308887	INFINITY
CFNVA3	.000000	12.953820	INFINITY
TFNVA34	.000000	6.308887	7.917367
CFNVA4	.000000	23.133360	INFINITY
TFNVA45	.000000	6.504007	8.162234
CFNVA5	.000000	19.274740	INFINITY
TPAL51	.000000	3.657362	.321871
CFNPAL1	.000000	2.099991	15.243640
TPAL12	.000000	3.770477	.331825
CLTPAL1	.000000	29.100000	3269.191000
CFNPAL2	.000000	3.152113	2.333323
TPAL23	.000000	3.441213	1.026420
CLTPAL2	.000000	30.000000	1634.596000
CFNPAL3	.000000	6.325981	1.058165
TPAL34	.000000	3.547642	INFINITY
CLTPAL3	.000000	30.927830	1634.596000
CFNPAL4	.000000	4.316948	8.538154
TPAL45	.000000	3.547642	.312215
CLTPAL4	.000000	27.380190	3269.191000
CFNPAL5	.000000	8.782949	4.261218
CLTPAL5	.000000	28.227000	3269.191000
BOVP	.000000	INFINITY	307.407800
BOVC	.000000	INFINITY	236.901800
OVIN	.000000	INFINITY	32.691910
SEMBDH	.000000	44.923980	5.261494
SEMBDM	.000000	29.512120	270.872600
SEMBDT	.000000	190.781100	340.293200
SEMBTH	.000000	23.436740	56.816310
SEMBTM	.000000	26.417130	61.800540
SEMBTT	.000000	222.055000	69.677950
SEMOGH	.000000	62.058010	INFINITY
SEMOGM	.000000	1.666275	INFINITY
SEMOGT	.000000	158.305400	1.666275
SEMAU	.000000	1338.313000	684.464500
ARBICULT	.000000	.000000	INFINITY
TRVARB1	.000000	.000000	INFINITY
TRVARB2	.000000	.000000	INFINITY
TRVARB3	.000000	582.472900	INFINITY
TRVARB4	.000000	582.472900	INFINITY
TRVARB5	.000000	180.000000	INFINITY
PREP1	.000000	2657.305000	195.184400
EPAND1	.000000	321.436700	756.339600
SEMIS1	.000000	2755.666000	302.535900
DESHER1	.000000	INFINITY	9661.038000
MOISS1	.000000	INFINITY	13541.900000
TRAVFUR1	.000000	.000000	INFINITY
TRAVFN1	.000000	.000000	INFINITY
TRAVFV1	.000000	.000000	193.646200
TRAVEN1	.000000	.000000	INFINITY

FMHOMM1	.000000	.000000	584.560900
FMFEMM1	.000000	INFINITY	.000000
PREP2	.000000	INFINITY	114142.800000
EPAND2	.000000	321.436700	756.339600
SEMIS2	.000000	.000000	INFINITY
DESHER2	.000000	734.591600	465.439800
MOISS2	.000000	INFINITY	7728.830000
TRAVFUR2	.000000	.000000	INFINITY
TRAVFN2	.000000	.000000	INFINITY
TRAVFV2	.000000	.000000	INFINITY
TRAVEN2	.000000	.000000	INFINITY
FMHOMM2	.000000	.000000	.000000
FMFEMM2	.000000	.000000	INFINITY
PREP3	.000000	4953.612000	2299.633000
EPAND3	.000000	15789.640000	7330.078000
SEMIS3	.000000	12631.710000	5864.063000
DESHER3	.000000	734.591500	465.439800
MOISS3	.000000	582.472900	INFINITY
TRAVFUR3	.000000	19096.840000	INFINITY
TRAVFN3	.000000	1275.001000	15.610730
TRAVFV3	.000000	402.472900	INFINITY
TRAVEN3	.000000	582.472900	12913.460000
FMHOMM3	.000000	INFINITY	3320.095000
FMFEMM3	.000000	INFINITY	3320.095000
PREP4	.000000	582.472900	INFINITY
EPAND4	.000000	15789.640000	7330.078000
SEMIS4	.000000	582.472900	INFINITY
DESHER4	.000000	INFINITY	3345.382000
MOISS4	.000000	360.461500	201.690600
TRAVFUR4	.000000	582.472900	INFINITY
TRAVFN4	.000000	582.472900	INFINITY
TRAVFV4	.000000	402.472900	INFINITY
TRAVEN4	.000000	582.472900	3561.334000
FMHOMM4	.000000	INFINITY	3320.095000
FMFEMM4	.000000	INFINITY	3320.095000
PREP5	.000000	706.545700	195.184400
EPAND5	.000000	180.000000	INFINITY
SEMIS5	.000000	180.000000	INFINITY
DESHER5	.000000	180.000000	INFINITY
MOISS5	.000000	2091.149000	201.690600
TRAVFUR5	.000000	180.000000	INFINITY
TRAVFN5	.000000	180.000000	INFINITY
TRAVFV5	.000000	99.192090	180.000000
TRAVEN5	.000000	180.000000	INFINITY
FMHOMM5	.000000	INFINITY	1026.000000
FMFEMM5	.000000	INFINITY	1026.000000
FMHOMME	.000000	INFINITY	373.049500
FMFEMME	.000000	INFINITY	357.717200
PMHOMME	.000000	INFINITY	INFINITY
PMFEMME	.000000	INFINITY	INFINITY
ENAVI	.000000	53.983730	INFINITY
MECHEN3	.000000	INFINITY	25826.920000
MECHEN4	.000000	.000000	7122.669000

RIGHTHAND SIDE RANGES

ROW	CURRENT RHS	ALLOWABLE INCREASE	ALLOWABLE DECREASE
SUPBD	.000000	INFINITY	355020.600000
SUPBT	.000000	INFINITY	58000.000000
SUPOG	.000000	INFINITY	140050.000000
SUPBDH	.000000	INFINITY	355020.600000
SUPBTH	.000000	INFINITY	58000.000000
SUPOGH	.000000	INFINITY	.000000
SUPBDM	.000000	INFINITY	.000000
SUPBTM	.000000	INFINITY	.000000
SUPOGM	.000000	INFINITY	.000000
SUPBDT	.000000	INFINITY	.000000
SUPBTT	.000000	INFINITY	.000000
SUPOGT	.000000	INFINITY	140050.000000
SUPAU	.000000	29000.000000	3061.717000
SUPFV	.000000	15383.760000	500.000000
SUPBS	.000000	INFINITY	.000000
SUPTM	.000000	INFINITY	3380.000000
SUPPQ	.000000	INFINITY	4563.000000
SUPPDT	.000000	INFINITY	6049.000000
SUPPM	.000000	INFINITY	1183.000000
SUPACM	.000000	INFINITY	4225.000000
SUPVRT	.000000	INFINITY	45972.750000
SUPFN	.000000	.000000	20094.770000
SUPEN	.000000	INFINITY	37350.000000
SUPJT	.000000	INFINITY	116606.600000
SUPPAT	.000000	INFINITY	166500.000000
IRRIG1	23000.000000	5235.254000	1337.188000
IRRIG2	2500.000000	11323.840000	2500.000000
TERREPO	115000.000000	96723.980000	1000.000000
TERREPM	604300.000000	205091.900000	115533.400000
TERREPF	363000.000000	13793.680000	90825.150000
PATURAGE	96100.000000	13793.680000	90825.150000
JACH	26450.000000	5172.631000	26450.000000
CULTMARI	16900.000000	1337.188000	3316.640000
LEGUME	57000.000000	500.000000	15383.760000
AUTCERLS	29000.000000	3061.717000	29000.000000
ARBOCULT	82900.000000	90825.150000	13793.680000
FIXTM	.000000	2999.807000	2000.912000
FIXPQ	.000000	4736.699000	4563.000000
FIXPDT	.000000	3928.044000	3549.000000
FIXPM	.000000	3386.095000	1183.000000
FIXAUT	.000000	3154.012000	1977.762000
CERLEGMI	.000000	1337.188000	.000000
ASSOLBS1	.000000	1337.188000	.000000
ASSOLBS2	.000000	.000000	.000000
CERLEG1	.000000	1000.000000	57000.000000
CERJCT1	.000000	.000000	1000.000000
CERJCP1	.000000	1000.000000	.000000
CERLEG2	.000000	208902.300000	3061.717000
CERJCT2	.000000	205091.900000	115533.400000
CERJCP2	.000000	208902.300000	26450.000000

CERLEG3	.000000	29000.000000	.000000
CERJCT3	.000000	.000000	90825.150000
CERJCP3	.000000	90825.150000	13793.680000
PRODBD	.000000	INFINITY	443301.800000
PRODBT	.000000	INFINITY	110000.000000
PRODOG	.000000	INFINITY	126045.000000
PRDBDH	.000000	INFINITY	443301.800000
PRDBTH	.000000	INFINITY	110000.000000
PRDOGH	.000000	INFINITY	.000000
PRDBDM	.000000	.000000	162185.400000
PRDBTM	.000000	.000000	.000000
PRDOGM	.000000	INFINITY	.000000
PRDBDT	.000000	.000000	130905.300000
PRDBTT	.000000	.000000	130796.500000
PRDOGT	.000000	INFINITY	126045.000000
PRODAU	.000000	INFINITY	31900.000000
PRODFV	.000000	INFINITY	57000.000000
PRODBS	.000000	.000000	21082.990000
PRODTM	.000000	INFINITY	66586.000000
PRODPQ	.000000	INFINITY	53843.400000
PRODPDT	.000000	INFINITY	59474.300000
PRODPM	.000000	INFINITY	8399.300000
PRODACM	.000000	INFINITY	63375.000000
RFVVA1	.000000	465898.900000	.000000
RFVVA2	.000000	460901.800000	.000000
RFVVA3	.000000	12175.750000	811406.900000
RFVVA4	.000000	311822.100000	.000000
RFVVA5	.000000	80171.820000	.000000
RFVOG1	.000000	327800.900000	.000000
RFVOG2	.000000	324285.100000	735675.600000
RFVOG3	.000000	8566.716000	.000000
RFVOG4	.000000	415762.800000	.000000
RFVOG5	.000000	56407.940000	.000000
RFVSG1	.000000	293772.000000	.000000
RFVSG2	.000000	290621.100000	.000000
RFVSG3	.000000	7677.406000	.000000
RFVSG4	.000000	371532.800000	33701.500000
RFVSG5	.000000	50552.240000	426900.200000
RFVBRG1	.000000	579242.900000	.000000
RFVBRG2	.000000	573030.300000	.000000
RFVBRG3	.000000	.000000	.000000
RFVBRG4	.000000	545688.800000	.000000
RFVBRG5	.000000	99676.060000	.000000
RFVLZ1	.000000	.000000	.000000
RFVLZ2	.000000	330603.100000	.000000
RFVLZ3	.000000	8733.622000	.000000
RFVLZ4	.000000	371532.800000	.000000
RFVLZ5	.000000	57506.950000	.000000
RFVPAT1	.000000	316684.800000	88911.130000
RFVPAT2	.000000	313288.200000	268040.000000
RFVPAT3	.000000	8276.209000	268040.000000
RFVPAT4	.000000	323371.100000	36330.060000
RFVPAT5	.000000	54495.090000	.000000

RENVA1	.000000	385542.000000	.000000
RENVA2	.000000	381406.800000	.000000
RENVA3	.000000	10075.710000	468750.000000
RENVA4	.000000	.000000	.000000
RENVA5	.000000	428380.000000	.000000
RENMS1	.000000	201406.600000	.000000
RENMS2	.000000	181265.900000	.000000
RENMS3	.000000	4788.546000	.000000
RENMS4	.000000	.000000	66859.380000
RENMS5	.000000	223785.100000	.000000
RENSG1	.000000	270924.400000	.000000
RENSG2	.000000	243831.900000	.000000
RENSG3	.000000	6441.367000	.000000
RENSG4	.000000	334474.600000	85431.440000
RENSG5	.000000	301027.100000	76888.290000
RFNVA1	.000000	INFINITY	.000000
RFNVA2	.000000	INFINITY	.000000
RFNVA3	.000000	INFINITY	.000000
RFNVA4	.000000	INFINITY	.000000
RFNVA5	.000000	INFINITY	.000000
RPAILL1	.000000	224883.300000	.000000
RPAILL2	.000000	224883.300000	.000000
RPAILL3	.000000	156590.700000	.000000
RPAILL4	.000000	224883.300000	251054.100000
RPAILL5	.000000	224883.300000	.000000
PRDPL4H	.000000	220473.800000	246131.500000
PRDPL4M	.000000	220473.800000	40600.000000
PRDPL4T	.000000	220473.800000	154055.000000
FVVA1	.000000	.000000	465898.900000
FVVA2	.000000	.000000	460901.800000
FVVA3	.000000	811406.900000	12175.750000
FVVA4	.000000	.000000	311822.100000
FVVA5	.000000	.000000	80171.820000
FVOG1	.000000	.000000	327800.900000
FVOG2	.000000	735675.600000	324285.100000
FVOG3	.000000	.000000	8566.716000
FVOG4	.000000	.000000	415762.800000
FVOG5	.000000	.000000	56407.940000
FVSG1	.000000	.000000	293772.000000
FVSG2	.000000	.000000	290621.100000
FVSG3	.000000	.000000	7677.406000
FVSG4	.000000	33701.500000	371532.800000
FVSG5	.000000	426900.200000	50552.240000
FVBRG1	.000000	.000000	579242.900000
FVBRG2	.000000	.000000	573030.300000
FVBRG3	.000000	.000000	15137.880000
FVBRG4	.000000	.000000	545688.800000
FVBRG5	.000000	.000000	99676.060000
FVLZ1	.000000	.000000	334187.500000
FVLZ2	.000000	.000000	330603.100000
FVLZ3	.000000	.000000	8733.622000
FVLZ4	.000000	.000000	371532.800000
FVLZ5	.000000	.000000	57506.950000

FVPAT1	.000000	88911.130000	316684.800000
FVPAT2	.000000	268040.000000	313288.200000
FVPAT3	.000000	268040.000000	8276.209000
FVPAT4	.000000	36330.060000	323371.100000
FVPAT5	.000000	.000000	54495.090000
ENVA1	.000000	.000000	385542.000000
ENVA2	.000000	.000000	381406.800000
ENVA3	.000000	468750.000000	10075.710000
ENVA4	.000000	421875.000000	.000000
ENVA5	.000000	.000000	428380.000000
ENMS1	.000000	.000000	201406.600000
ENMS2	.000000	.000000	181265.900000
ENMS3	.000000	.000000	4788.546000
ENMS4	.000000	.000000	248650.200000
ENMS5	.000000	.000000	223785.100000
ENSG1	.000000	69199.460000	270924.400000
ENSG2	.000000	62279.510000	243831.900000
ENSG3	.000000	.000000	6441.367000
ENSG4	.000000	85431.440000	334474.600000
ENSG5	.000000	76888.290000	301027.100000
FNVA1	.000000	.000000	INFINITY
FNVA2	.000000	.000000	INFINITY
FNVA3	.000000	.000000	INFINITY
FNVA4	.000000	.000000	INFINITY
FNVA5	.000000	.000000	INFINITY
FNPAL1	.000000	77947.440000	INFINITY
FNPAL2	.000000	75609.020000	INFINITY
FNPAL3	.000000	73340.750000	156590.700000
FNPAL4	.000000	82843.480000	INFINITY
FNPAL5	.000000	80358.180000	INFINITY
UF1	.000000	6819947.000000	23854130.000000
MAD1	.000000	1395772.000000	INFINITY
MS1	.000000	29433650.000000	14934820.000000
FOIN1	.000000	121560.400000	INFINITY
LITIER1	.000000	77947.440000	21936.100000
UF2	.000000	46308370.000000	22987240.000000
MAD2	.000000	3914377.000000	INFINITY
MS2	.000000	28445170.000000	57204460.000000
FOIN2	.000000	151712.300000	INFINITY
LITIER2	.000000	75609.020000	37905.200000
UF3	.000000	13254050.000000	634828.300000
MAD3	.000000	4221389.000000	INFINITY
MS3	.000000	1390194.000000	20617410.000000
FOIN3	.000000	82286.780000	INFINITY
LITIER3	.000000	73340.750000	37905.200000
UF4	.000000	2786705.000000	INFINITY
MAD4	.000000	2427842.000000	INFINITY
MS4	.000000	71659610.000000	6102530.000000
FOIN4	.000000	100936.600000	INFINITY
LITIER4	.000000	82843.480000	21936.100000
UF5	.000000	35299460.000000	4180057.000000
MAD5	.000000	555985.900000	INFINITY
MS5	.000000	9153796.000000	26779050.000000

FOIN5	.000000	120729.400000	INFINITY
LITIER5	.000000	80358.180000	21936.100000
CONCTR	.000000	139230.000000	INFINITY
BOVPMAX	.000000	13423.870000	.000000
BOVCMAX	198900.000000	16516.360000	5686.011000
OVINMAX	1199110.000000	126771.900000	26689.020000
LAITBP	.000000	INFINITY	.000000
LAITBC	.000000	INFINITY	248625.000000
WOOLOV	.000000	INFINITY	3597.330000
VIANDBP	.000000	INFINITY	.000000
VIANDBC	.000000	INFINITY	37592.100000
VIANDOV	.000000	INFINITY	37172.410000
SEMBD	.000000	INFINITY	40827.370000
SEMBT	.000000	INFINITY	6960.000000
SEMOG	.000000	INFINITY	14005.000000
SEMBDH	.000000	INFINITY	40827.370000
SEMBTH	.000000	INFINITY	6960.000000
SEMOGH	.000000	INFINITY	.000000
SEMBDM	.000000	INFINITY	.000000
SEMBTM	.000000	INFINITY	.000000
SEMOGM	.000000	.000000	14005.000000
SEMBDT	.000000	INFINITY	.000000
SEMBTT	.000000	INFINITY	.000000
SEMOGT	.000000	INFINITY	14005.000000
SEMAU	.000000	INFINITY	3335.000000
SEMCFV	.000000	INFINITY	5415.000000
SEMCBS	.000000	INFINITY	.000000
SEMCPQ	.000000	INFINITY	9.126000
SEMCPT	.000000	INFINITY	15122.500000
SEMVT	.000000	INFINITY	3262.012000
SEMCEN	.000000	INFINITY	3586.250000
SEMFN	.000000	INFINITY	.000000
ARBCULT1	.000000	INFINITY	.000000
ARBCULT2	.000000	INFINITY	.000000
ARBCULT3	.000000	INFINITY	.000000
ARBCULT4	.000000	INFINITY	.000000
ARBCULT5	.000000	INFINITY	.000000
SALAR	2442.000000	880.891600	322.926500
TRAV1	.000000	5154.416000	3498.184000
TRAV2	.000000	9921.464000	3057.436000
TRAV3	.000000	5021.082000	1840.681000
TRAV4	.000000	1602.215000	1840.681000
TRAV5	.000000	726.482600	2038.574000
FMHOMME	37950.000000	4933.595000	3229.266000
FMFEMME	25590.000000	5223.408000	3363.818000
PMHOMME	12800.000000	3746.727000	2409.900000
PMFEMME	450.000000	4396.131000	450.000000
FMHOMM1	.000000	INFINITY	613.716500
FMHOMM2	.000000	INFINITY	536.392300
FMHOMM3	.000000	880.891600	322.926500
FMHOMM4	.000000	281.090400	322.926500
FMHOMM5	.000000	127.453100	357.644600
FMFEMM1	.000000	904.283400	613.716500

FMFEMM2	.000000	INFINITY	1484.220000
FMFEMM3	.000000	880.891600	322.926500
FMFEMM4	.000000	281.090400	322.926500
FMFEMM5	.000000	127.453100	357.644600
PMHOMM1	.000000	904.283400	613.716500
PMHOMM2	.000000	1740.608000	536.392300
PMHOMM3	.000000	880.891600	322.926500
PMHOMM4	.000000	281.090400	322.926500
PMHOMM5	.000000	127.453100	357.644600
PMFEMM1	.000000	904.283400	20.250000
PMFEMM2	.000000	1740.608000	30.150000
PMFEMM3	.000000	880.891600	30.600000
PMFEMM4	.000000	281.090400	20.250000
PMFEMM5	.000000	127.453100	20.250000
MOPREP1	.000000	1592964.000000	3498184.000000
MOPREP2	.000000	89924.890000	3057436.000000
MOPREP3	.000000	133035.800000	1840681.000000
MOPREP5	.000000	726482.600000	2038574.000000
MOEPAND1	.000000	454876.300000	3498184.000000
MOEPAND2	.000000	397426.300000	3057436.000000
MOEPAND3	.000000	78544.910000	1840681.000000
MOEPAND4	.000000	65768.510000	1840681.000000
MOSEMIS1	.000000	3446511.000000	3498184.000000
MOSEMIS3	.000000	1281646.000000	1840681.000000
MODESH1	.000000	300000.000000	3498184.000000
MODESH2	.000000	3514437.000000	3057436.000000
MODESH3	.000000	5021082.000000	1840681.000000
MODESH4	.000000	1602215.000000	1840681.000000
MOMOIS1	.000000	757965.000000	3498184.000000
MOMOIS2	.000000	375000.000000	3057436.000000
MOMOIS4	.000000	1602215.000000	1840681.000000
MOMOIS5	.000000	726482.600000	2038574.000000
TRACTION	.000000	4705109.000000	INFINITY
MOFURU3	.000000	.000000	1840681.000000
FOUROU3	.000000	.000000	INFINITY
MOPRESS3	.000000	5021082.000000	1840681.000000
PRESS3	.000000	803918.400000	INFINITY
RECFV1	.000000	756477.800000	3498184.000000
RECFV2	.000000	INFINITY	.000000
RECFV3	.000000	1972497.000000	4327504.000000
RECFV4	.000000	2008579.000000	2191421.000000
RECFV5	.000000	726482.600000	3473518.000000
MECHFV1	100.000000	INFINITY	100.000000
MECHFV2	150.000000	INFINITY	150.000000
MECHFV3	150.000000	INFINITY	103.035800
MECHFV4	100.000000	INFINITY	52.176690
MECHFV5	100.000000	INFINITY	82.702800
MORECEN3	.000000	99999.990000	1840681.000000
MORECEN4	.000000	36600.000000	1840681.000000
RECEN3	.000000	1074.743000	50000.000000
RECEN4	.000000	18300.000000	31700.000000
MECHEN3	50.000000	1.074743	50.000000
MECHEN4	50.000000	INFINITY	31.700000
BSTRAIT	.000000	.000000	INFINITY

MOISS	.000000	782903.100000	INFINITY
TRANS	.000000	4265638.000000	INFINITY
AMMON	.000000	60179.520000	INFINITY
SUP45	.000000	62333.880000	INFINITY
POTASSE	.000000	1940.000000	INFINITY
DESHERB	.000000	8595.212000	INFINITY
EAU1	.000000	150928.500000	INFINITY
EAU2	.000000	10000.000000	INFINITY
CREDIT	.000000	154977900.000000	INFINITY