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Technical Cooperation Programme

A MEDIUM-TERM AGRICULTURE SECTOR STRATEGY FOR REPUBLIKA SRPSKA

ANNEX 1

CROP, FRUIT AND VEGETABLE PRODUCTION

by

John Macartney

(including contributions by):

Jovo Stojcic (Team Leader)
Gavro Kremonovic
Dragisa Lopandic
Goran Perkovic

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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ABBREVIATIONS AND ACRONYMS

ARC	Agricultural Research Council
BiH	Republic of Bosnia and Herzegovina
CGIAR	Consultative Group on International Agricultural Research
CIS	Commonwealth of Independent States
DM	German Mark
EU	European Union
EU Phare	Poland and Hungary: Action for Restructuring of the Economy
FBiH	Federation of Bosnia and Herzegovina
ha	hectare
kg	kilogram
kw	kilowatt
m	metre
N	nitrogen
P	phosphorus
RS	Republika Srpska
SAVA	SAVA Agrokominate
STAP	Short-term Action Programme
USAID	United States Agency for International Development
UPI	United Agriculture and Industry

I. RESOURCE BASE AND PERFORMANCE

1.1 Land Resources and Climate

The Republika Srpska (RS) is geographically divided into two areas: the northern and western area centred on Banja Luka and bounded to the north by the Sava River, and the southern and eastern area bounded in the east by the Drina River. The two areas are joined in the north through the Posavina corridor between Brcko and Derventa. The topography is basically mountainous, ranging in altitude between 100 m and 2,000 m, draining mostly northwards to the valley of the Sava River or eastwards to the Drina. From the confluence of the two rivers near Bijeljina running westwards up the Sava valley towards Projedor there is an extensive area of relatively flat, fertile land. Soils in the northern area tend to be acidic, slow draining and relatively fertile, while in the eastern area they are thinner on a karst limestone base.

The climate is generally continental with high summer temperatures, reaching up to 41°C in Banja Luka and cold winters with minimum temperatures as low as -28°C. Snow may lie for three months or more at altitudes above 700 m.

Rainfall and temperature are conditioned by altitude, with higher rainfall and lower temperatures in the mountainous areas. Annual rainfall varies between 800-1,400 mm, with about 50 percent falling during the growing season (April-October). Rainfall is therefore marginal for optimum plant growth and, particularly on the lighter valley bottom soils, drought stress is common and is one of the factors limiting cereal yields.

It is estimated by the RS authorities that over 100,000 ha could be irrigated, compared to the 4,000 ha that are irrigated at present. Flooding is a problem in some areas along the river valleys. Drainage systems cover some 70,000 ha, but a further 200,000 ha could be improved. In the southern tip of RS around Trebinje, which enjoys a Mediterranean climate, there is a high potential for irrigation development.

1.2 Land Capability Classification

Three major classes are recognized:

- ***Flat Land Zone***: Altitude <250 m. Provides the most productive areas for a wide range of crops, including grains, vegetable, soya and fodder crops. The major fruits are apple and pear. Farms are mostly mixed, with most having livestock. The soils are mostly alluvial and very suited for irrigation.

- ***Hilly Zone***: 250-500 m. Less intensive agricultural systems with concentration on maize, oats, wheat and potato. Soils are low in P and generally show varying degrees of acidity.

- ***Hilly-Mountainous***: 500-1,000 m. Meadows and pastures predominate with home gardens. Severe winters provide a short growing period with concentration on oats, rye, potatoes and plums. Soils are critically short of P, which accounts for low yields achieved. These areas suffered most during the war with population exodus and machinery and livestock losses.

Of the estimated land area of RS, of about 2.5 million hectares, about half is considered agricultural land, the remainder being largely mountain and forest. Agricultural land in RS is composed of arable land and meadows (46 percent), orchards (4 percent) and pastures (50 percent). Meadows may be natural lowland grazing or leys in rotation with other crops, while pastures include extensive tracts of natural grazing on the mountains. The distinction is partly one of slope. Arable farming is possible on land with slopes up to 20 percent; intensive forage production may be possible on land up to a 25 percent slope; however, land over the 35 percent limit is only suitable for pasture and even then may require attention to hazards of erosion. Significantly, about 20 percent of the arable land was dedicated to forage crops (from 9 percent in Trebinje to 23.4 percent in Vlasenica), while a further 22 percent (and up to 48.5 percent in Trebinje) was either fallow or meadows on arable land (Table 1).

Table 1: Exploitation of Agricultural Land by RS Region (in percent)

RS Region	Arable Land				Pasture Land
	Plough Land	Orchards	Meadows	Total Arable Land	
Bijeljina	84.6	8.6	4.8	98.0	2.0
Doboj	77.6	7.7	7.1	92.4	7.6
Banja Luka	60.5	4.0	14.5	79.0	21.0
Vlasenica	59.6	7.4	8.8	75.8	24.2
Sokolac	11.9	2.6	23.7	38.2	61.8
Trebinje	10.7	1.7	3.0	15.4	84.6

Source: “Agricultural Resources and Agriculture”: Statistics Institute of RS, 1996.

The national land resources post-war are shown in Table 2.

Table 2: Land Resources (post-war)

	ha
Total Area	2,505,300
Arable Land	775,500
Cultivated	594,500
Orchards	54,000
Vineyards	1,000
Meadows	126,000
Pastures	465,500
Other	4,000
Total Agricultural Land	1,245,000
Arable Land/Person	0.56

Source: Office of High Representative

In 1988-1990, RS had some 443,000 ha under arable cultivation with some 173,000 ha under-utilized. The serious discrepancy is largely due to the land capability classification practised, which included Class IV & V as potentially cultivated land. This low potential land class is unsuited for arable production, which accounts for the significant areas of unutilized land in the “arable” land classification. There appears to be little scope for

increasing area under cultivation. Increase in production will therefore have to come from intensification of existing land and the diversification into high-yielding crops, particularly fruit and vegetables, suited to large areas currently supporting wheat and maize.

The cropping structure is shown in the following table. The figures are indicative only, but show the heavy concentration on maize and wheat and a lack of interest in industrial crops.

Table 3: Utilization of Available Land in RS

No	Crops	Harvest Area				Sowing	
		1988/90		1996		1997	
		ha	%	ha	%	ha	%
1.	Grains	282,250	63.7	176,127	61.6	239,940	67.3
	Wheat	87,881	19.8	30,313	10.6	61,093	17.1
	Rye	2,482		471		1,831	
	Barley	10,620		7,088		9,902	
	Oats	22,548	5.1	14,792		21,133	
	Hybrid Corn	127,926		123,463	43.2	145,981	40.9
	Native Corn	30,793					
2.	Vegetable Plants	46,271	10.4	34,664	12.1	37,555	10.2
	Potato	23,820	5.4	15,661	5.5	19,254	5.4
	Cabbage and Kole	4,381		2,563		3,196	
	Other Vegetables	18,070		16,440		15,105	
3.	Industrial Plants	8,983	2.0	5,788	2.0	7,070	2.0
	Tobacco	1,671		1,480		1,252	
	Soya	4,361	1.0	3,162		3,867	
	Other	2,951		1,146		1,951	
4.	Forage Plants	105,726	23.9	69,152	24.2	71,983	20.2
	Clovers	49,344		34,736		36,023	
	Lucerne	22,559		14,327		18,416	
	Mixed Grasses & Clovers	22,482		12,602		12,946	
	Other Forage	11,341		7,482		4,598	
5.	Total Harvest Land	443,230	100.0	285,731	100.0	356,548	
6.	Unsown Land	173,318	28.1	329,817	54.0	260,000	42.0
7.	Total Ploughlands	616,548	100.0	616,548	100.0	616,584	100.0

Source: Crop, Fruit and Vegetable Working Group

1.3 Water Resources

There are vast unexploited water resources in RS, both surface and groundwater. A World Bank assisted drainage scheme estimated that some 19,000 ha of drained land were suitable for summer irrigation.

There is an increasing number of private farmers who are installing low-cost overhead irrigation systems for vegetable production. In many cases, small pumps only are required, due to the low lift (4-5 m). The returns on these investments are high.

1.4 Unutilized Land

Land currently unutilized is high and is a factor of various circumstances which include:

- displacement of farmers as a result of the war;
- progressive abandonment of marginal land (pre-war), due to:
  - ageing farmers, with beneficiaries leaving rural areas;
  - land capability and size of holding unable to support subsistence level of survival;
- mined land;
- the fact that land classes IV & V are included in arable classification; these classes are not suitable for arable cultivation.

While the problem of abandoned/under-utilized land is serious, the causes and remedies have not been defined. The relationship between abandoned land and its capability to support profitable farming would seem to be a logical starting point. The vast proportion of this land appears to be upland/mountainous, predominantly pasture, where extensive livestock rearing would be the optimum utilization and where an economic unit is unlikely to be below 10 ha.

Attempts to resettle farmers directly on existing holdings are likely to be unsuccessful. It is now an accepted approach that financial assistance should focus on areas where people are actually returning, rather than areas with limited potential for production. Whilst a system allowing sub-economic rentals is being currently practised for grazing, this is unsatisfactory in that the resource base is being exploited by the short-term arrangements. It is recommended that a land sector study be initiated which would elucidate title claims, area involved and optimum land use and holding size. This would provide the basis for negotiating an equitable resettlement programme based on optimum land use.

1.5 Farm Size Distribution

With a total number of farm households of 258,000, the farm size distribution is given in Table 4 :

Table 4: Farm Size Distribution

Farm Size	No. of Farmers %
Less than 1 ha	34.5
1-2 ha	19.5
2-5 ha	29.5
5-10 ha	13.7
Over 10 ha	2.8

Farm size is further fragmented as a result of previous hereditary rights. This system is now being controlled under new legislation. Land consolidation is the long-term objective, but at present the only alternative to developing commercial farming systems is for the farmers to join together in associations of growers in order to produce commercial quantities of acceptable quality product.

1.6 Crop Yields

Crop yields in FBiH, prior to the war, were generally poor when compared with those of former Yugoslavia as a whole; cereals in particular averaged nearly 20 percent below.

Compared with western Europe, FBiH average yields were only about half for cereals and vegetables, and less than half for clover and potatoes. Although FBiH conditions are not ideal for the crops grown, yield levels reported on some of the more efficient units in the past suggest there is substantial room for technical improvement.

Yield data reported from two cantons (1990 and 1997) are given in Table 5 and show the low levels of production, particularly for cereals and potatoes. The effect of war damage on the fruit orchards is clearly shown.

Table 5: Yields in t/ha: Selected Cantons (1990 & 1997)

Crop	1990		1997	
	Middle Bosnia Canton	Herzegovina – Neretva Canton	Middle Bosnia Canton	Herzegovina – Neretva Canton
Wheat	3.1	2.4	2.8	2.4
Rye	3.0	2.5	2.9	2.4
Barley	2.2	2.3	2.8	2.5
Oats	1.9	1.9	2.2	1.9
Maize	2.1	1.7	3.3	3.0
Potato	6.0	5.8	9.2	12.4
Onion	3.1	3.3	8.5	9.2
Tomato	2.7	11.0	9.4	18.2
Paprika	1.5	2.8	7.2	17.5
Fodder				
- Maize	17.3	13.3	19.5	32.0
- Alfalfa	3.9	2.9	6.5	3.9
- Vetch	3.6	2.4	6.0	4.5
Apple	8.3	5.9	35.1	7.8
Pear	17.2	6.6	39.5	6.8
Plum	7.3	2.1	21.5	12.3
Cherry	16.3	21.4	11.8	11.6

Source: Crop, Fruit and Vegetable Working Group

More recent statistics (crop year 1998) show no difference in the yields achieved by state and private farms.

Table 6: The Yields of More Important Farming Crops in RS (in t/ha)

Crops	1988/90	1996
Wheat	3.39	2.60
Rye	2.23	1.80
Barley	2.64	2.30
Oats	1.95	1.90
Hybrid Corn	3.36	3.50
Potato	6.18	8.50
Tobacco	1.44	1.40
Soya	1.61	1.80
Hay of:		
- clovers	3.11	3.60
- lucerne	3.37	3.70
- mixture of clovers & grasses	2.36	3.70

1.7 Current Production Systems and Summary Gross Margins

The low yields produced by the cereal crops are a serious cause for concern. The gross margin analyses (carried out by the working group in FBiH are relevant and are summarized in Table 7), identify that it is not profitable to grow wheat/maize and as the majority of farmers practice this pattern, there is a continuing slide into a poverty trap. Paradoxically the high cost of production negatively affects yield. A similar situation is presented by the RS working group (Appendix 1).

Table 7: Summary Gross Margins and Yields

	DM/ha	Yield t/ha
Maize:		
hilly	561	8.0
flat	168	8.5
state farm	72	3.2
RS	451	5.5
Wheat:		
hilly	-3	4.0
flat	214	5.0
state farm	7	3.0
RS	399	4.0
Oats: state farm	19	2.4
Rye: state farm	110	3.0
Potato: hilly	2,177	16.0
Tomato:		
hilly	1,277	30.0
flat	6,733	70.0
Strawberry: hilly	1,555	10.0
Paprika: flat	7,613	25.0
Peach: hilly	7,133	25.0
Plum: hilly	2,236	20.0
Apple: hilly	3,968	30.0
Pear: hilly	2,536	25.0

Source: Crop, Fruit and Vegetable Working Group, FBiH.

The results are only indicative, but clearly (on yields presented) these case studies were carried out on the "better managed" farms (i.e. acceptance of state advisory service) With lower yields (i.e. averages quoted), the present important position of cereals in the cropping systems has to be seriously reconsidered.

The official costs[1] for state land cultivation vary from DM900-1,350 (wheat, maize). Costs collected by the mission in RS on an efficient operation showed a cost of DM260, which included DM120 for contract ploughing. Even at these lower costs, maize/wheat remains unprofitable at yields of 5.5 tonnes and 4 tonnes, respectively.

The present practice consists of deep mouldboard ploughing followed by three harrowings. Deep ploughing is expensive and unnecessary. It creates an impermeable plough pan and provides for proliferation (rather than control) of weeds and grasses. The following harrowings are necessary to provide for a seed bed which, in most cases, is unsatisfactory and is the main reason for the high seed rates: 270 kg/ha for wheat.[2]

The heavy weed growth, particularly with wheat, is a major cause of the low yields. It was estimated from inspection of stubbles that about 50 percent of the crop was either annual or perennial grasses. Maize seed is almost exclusively hybrid, imported and replaced annually, whereas wheat seed is currently 80 percent uncertified and clearly of low yield potential.

Some soils (about 30 percent) are acidic, and with a large proportion of compact clays with poor permeability, these soils are more suited to the growing of oats/rye or livestock forage.

A package of practices can be derived which, with current knowledge, could increase yields and significantly decrease cultivation costs. However, there are areas which are not suited to the wheat/maize systems, but alternative crops with comparative advantage can be planted.

A recent summary of production by state enterprise "Spreca" states that the break-even point for wheat is 3 t/ha, rye 2.8 t/ha and maize 4 t/ha. It also concluded that current levels of production/costs are unattractive, but that fodder maize production at 340 t/ha is giving a gross margin of DM600/ha. Similar margins are reported for clover grass (green and hay) and cereal/legume soilage.

1.8 Fruit Production

RS climate and soils are suited to fruit growing, which is widely practised throughout the republic, from small garden orchards to semi-commercial plantations.

In all regions, except in the Mediterranean zone, plum is the leading fruit with 60-70 percent of land. Lowland and Mediterranean regions concentrate on apple and pear trees, with limited areas suitable for peach and cherries, depending on climate and tradition.

[1] Faculty of Agriculture, Sarajevo.
[2] Usual rates are 100kg/ha.

Table 8: Production of Fruit Pre-war (1988/89) and Post-war (1996)

Fruit	Pre-war 1988-89				Post-war (1996)			
	No. of fertile trees '000	kg/Tree	tonnes	%	No. of fertile trees '000	kg/tree	tonnes	%
Plum	7,723	13.3	96,578	62.7	6,540	10.6	68,628	62.4
Apple	1,435	17.8	25,503	16.6	1,449	14.2	20,633	18.7
Pear	1,015	15.5	15,713	10.2	786	12.4	9,746	8.9
Cherry	414	18.0	7,468	4.8	361	14.4	5,198	4.7
Sour Cherry	325	10.7	3,496	2.3	251	8.5	2,148	1.9
Peach	115	13.9	1,613	1.0	89	11.1	990	0.9
Walnut	272	9.4	2,567	1.7	254	7.5	1,910	1.7
Apricot	32	14.0	456	0.3	30	11.2	336	0.3
Quince	55	9.9	5,509	0.4	50	7.9	396	0.4
Total	10,941	14.0	153,884	100.0	9,720	11.3	109,985	100.0

Source: 1998/99 SR BiH, RZS Statistical Review 3/89, 3/90, 2/91.

In general, pre-war yields were comparative to smallholder western European fruit-growing areas. Lack of maintenance during the war, particularly pest and fungal controls, have had a serious impact on production, together with a delay in replanting programmes. Many orchards are over-mature and harvesting is now difficult.

Average annual volume of production before the war (RS) was about 154,000 t, of which plum with 96,500 t (62.7 percent), apple 25,500, t (16.6 percent), pear 15,700 t (10.20 percent) and cherry 7,400 t (4.8 percent).

After the war, yields per tree have been estimated at 80 percent of the yields achieved pre-war. Current volume of production is about 110,000 t, with plum contributing about 60 percent and apple 19 percent.

The lack of maintenance during the war has exacerbated a situation of pre-war neglect, delayed replanting and poor management. Yields and quality have shown progressive deterioration. As RS has a comparative advantage in fruit production, both for regional and export markets, the rehabilitation of the fruit orchards must be awarded high priority.

Berry Fruits

A small but profitable berry fruit industry operated before the war, producing up to 10,000 tonnes annually from 600-700 ha. Twenty percent of this crop was exported to high-value markets in Europe, mostly in Germany and Austria. Average pre-war production and exports for the period 1988-1991 are presented in Table 9. Approximately 60 percent of the pre-war area was reported damaged during the war.

Berry fruit production is ideally suited to the agro-climatic and economic conditions in FBiH (above 500 m altitude). It generates high returns to both land and labour, has a high demand for seasonal labour (in a low-wage environment) and thereby generates rural employment; furthermore it is export-oriented. Investment requirements are moderate at DM8,000/ha (compared with DM45,000-50,000/ha for viticulture); returns begin in the first

year of investment and reach their peak after three to seven years . Gross returns, under good management, range from DM6,000-8,500/ha for land and DM3,500-5,000/person year for labour.[1]

Table 9: Pre-war Production and Exports of Berry Fruit in FbiH

Fruit	Average Production 1988-91 (tonnes)	Average Exports 1988-91 (tonnes)
Strawberry	6,930	1,305
Raspberry	2,322	495
Blackberry	1,071	225

Source: Agriculture Institute, University of Sarajevo.

In RS, 1996 statistics show a total production of 1,153 tonnes over a total of 300 ha over six municipalities.

In addition to the difficulty of finding start-up capital for production, lack of processing will also prove to be a constraint. Much of the existing cool-store capacity was damaged during the war or is now located in the area of the other political entity. However, in the short term, processors are actively seeking supplies for jam-making. A considerable effort is also needed to develop exports, both to re-establish former export outlets and to increase value-added (pre-war exports were mostly chilled raw fruit sold to European distributors). The crop is suited to small farm production and provides an excellent opportunity for farmer groups to combine their resources for commercial production. Value-added activities are attractive.

The rehabilitation and further growth of the berry fruit industry is awarded high priority.

Viticulture

According to statistical data in RS, there are about 693 ha of land under vineyards, and almost all are in the territory of Srpska Herzegovina Municipality, Trebinje.

Before the war, there were 2,163,000 grapevines, of which 2,050,000 or 95 percent were fertile vines, and the social sector owned 1,548,000 or 71.5 percent. During the war, a considerable part of vineyards was destroyed, and current estimates suggest that about 649,000 vines, or 30 percent of pre-war numbers, are producing (Table 10).

Table 10: Number of Grapevines at Trebinje Municipality ('000 Grapevines)

Sector	Year 1989		Year 1996	
	Total	Fertile	Total	Fertile
Private	615	605	240	240
State	1,548	1,445	409	409
Total	2,163	2,050	649	649

[1] Agriculture Institute, University of Sarajevo.

War damage was largely due to destruction of trellis, irrigation systems and lack of supervision. Many nurseries were also destroyed.

Given the small contribution which this subsector makes to production, employment and exports, and in view of its continued dominance by the social sector, it is difficult to justify high levels of donor support for viticulture at this time. Some support could be given to re-establish nursery and laboratory facilities, but this would need to be balanced against priorities elsewhere in the agriculture sector. Additional support should be contingent on the privatization and disaggregation of the public sector monopoly.

1.9 Farm Mechanization

Farm mechanization levels in pre-war FBiH were high (see Table 11). In the mechanization drive which followed the establishment of a joint venture tractor and combine manufacture in Former Yugoslavia in the 1950s, farmers were offered subsidized prices and highly attractive credit terms for the acquisition of farm machinery. Figures provided by the Ministry of Agriculture, Forestry and Water Management (MAFWM) of RS indicated a rate of one tractor per 40 ha of arable land. Farmers in RS favoured four-wheel tractors, rather than the two-wheel models.

In RS, the farming system could be considered to be over-mechanized with 14,250 units (1991) and a high degree of multi-farm use of farm equipment through informal arrangements between relatives and neighbours. Grain harvesting by contract with local combine-owning cooperatives was the only operation for which farmers relied on outside assistance.

About 80 percent of pre-war tractors and implements in FBiH were of the IMT brand produced in Belgrade under foreign licence. Support services were available from a network of local workshops and parts stockists dependent on nation-wide machinery trading conglomerates and import/export companies. Also, associated with the near monopoly enjoyed by the main domestic tractor manufacturer and the consequently high degree of standardization, a strong body of skills and expertise in operation, maintenance and minor repair was built up among the farmer-owners of the equipment, as well as local mechanics and part outlets.

However, the monopoly and resultant standardization of equipment is the major reason why no progress was made in the introduction of alternative forms of cultivation.

Comprehensive field visits carried out by the mission indicated that the capacity of existing post-war inventories were capable of maintaining pre-war levels of cultivation, seeding and harvesting. Machinery was undoubtedly lost as a result of war, but set against progressive deterioration and lack of replacement, as a direct result of socialist farming systems, the mission concluded that the main issue was not so much replacement of equipment due to war damage, but rather re-engineering of a totally unsatisfactory system of conventional equipment used pre-war.

The RS has produced a persuasive case for post-war rehabilitation of agricultural machinery, and donors have responded positively with various grants and imports of packages.

Table 11: Pre- and Post-war Conditions of Mechanization in RS

Type and Category	Farms		Cooperatives		Farms	
Mechanization	1991	1997	1991	1997	1991	1997
Tractors one-axle	150	114	26	15	12,613	9,977
tractors two-axle	558	324	201	130	24,889	22,325
Self-propelled mower	18	10	17	10	7,026	4,391
Repair trashier combine	236	87	109	60	1,362	1,071
Maize combine	81	18	31	17	1,219	1,093
Combine for silage	23	13	14	8	538	452
Ancillary Equipment						
Trailers	559	326	283	208	28,124	23,862
Ploughs	461	281	270	204	29,778	25,947
Disk harrows	175	130	150	112	22,919	18,810
Seed drills (wheat)	85	37	97	72	4,325	3,674
Corn drills	124	57	122	92	8,040	5,695
Digger	13	4	12	6	2,001	1,689
Fertilization distributors	136	65	48	25	4,140	3,626
Sprayers	130	74	67	39	10,578	8,152

Source: Crop, Fruit and Vegetable Working Group

The RS authorities estimate a loss of 40 percent of pre-war farm machinery, which was translated (from a previously over-mechanized situation) into an urgent requirement for 5,700 tractors, 1,800 combines and 13,000 other agricultural machines. Whilst these figures cannot be disputed, replacement alone may not provide the optimum benefits. The organization of machinery utilization and immediate attention to the importation of cultivation equipment suited for reduced tillage systems must run in parallel. The intensity and power requirements of current land preparation systems could be reduced by 50 percent, to the benefit of gross margin and profitability, particularly of cereal growing.

Efforts must now be made to establish a solid policy framework for agricultural mechanization and other key investments to assist agriculture to evolve into a competitive and profitable sector through joint small farmer enterprises, based on cropping systems with comparative advantage.

1.10 Seed Production

Farmers in Republika Srpska plant about 20 percent certified wheat seed and the rest is own seed (without certificate). At state farms and cooperatives, certified seed accounts for about 90 percent. As about 95 percent of land is privately farmed, yields are accepted to be about 20-30 percent lower.

The Agricultural Institute in Banja Luka has 11 of its own wheat varieties, as well as ongoing activities for further improvements. With its production (600 ha or 2,400 tonnes) the institute can meet about 20 percent (8,000-9,000 ha) of needs for farmers in Republika Srpska. The rest of certified seed (about 80 percent) comes from the Agricultural Institute in Novi Sad (Yugoslavia). As the climate in Republika Srpska is quite humid, the protein content in Banja Luka varieties varies between 11-13 percent. To improve bread quality, it is necessary to have varieties with a high percentage of proteins (as well as good composition of amino acids) from Novi Sad.

The major blockage to increasing wheat seed production at the institute is the low capacity of the seed processing unit. During the war, seed was consumed, leaving a critical situation for rehabilitation of home-grown food supplies. FAO responded effectively to counter the immediate requirements of the critical post-war situation. Immediate imports of wheat, potato, food bean, vegetable and forage seed were negotiated on combined selection principles of FAO, UPI (the implementing partner) and the agricultural institutes.

Breeder seed was released to selected (public and private) growers on a "return" basis. Given that varieties were selected on an "ad hoc" basis and that no field inspections were possible, the crash operation appears to have been very successful. It is unfortunate that no formal recordings of yields were made; however, field checks made by the mission indicated that the importations produced, in some cases, yields of wheat at 7 t/ha and potatoes at 20 t/ha. The indications are that current low levels of production are due largely to uncertified seed supplies and variety.

FAO, as part of the rescue programme, financed a facility for seed testing laboratories and promotion of a seed quality law and plant breeders rights. Laboratory tests were carried out under ISTA (International Seed Testing Association), rules for sampling, purity, germination, varietal priority, etc. However, the institutional capability available would suggest that these controls are not sustainable.

It is clear that the varietal limitations and seed quality (certification) are a major factor in the low levels of yield being achieved, particularly with wheat, maize and potatoes. This issue is disputed by RS scientists. In the short term, there is no justification to support RS breeding capability, but rather to capitalize on the FAO initiative and concentrate on introduction of cultivars, strengthening seed certification services (particularly with wheat) and improvement of seed processing facilities at the Institute of Banja Luka.

Orchard and Berry Fruit - Planting Material

Before the war, the territory of RS had satisfactory facilities at four fruit planthouses (Brcko, Prijedor, Gradiska and Trebovljevo), supported by the Agricultural Institute, Banja Luka.

During the war, all planthouses were destroyed, except the institute facility at Banja Luka which could produce about 30,000 fruit seedlings/annum.

The re-establishment of the necessary planting material facilities for fruit trees would require a total area of about 25 ha to service an annual requirement of about 500,000 seedlings/year. Planting material of berry fruits, awarded high priority by the sector team, would require some 5 ha to fulfil immediate demand.

Potato Seed Production and Storage

The FAO Seed Support Project made importation in spring 1998 to part-replace the critical stock seed situation. Well-recognized Dutch-bred varieties (Desiree, Kondor, Jaeria and Kennebee) were imported as elite seed and overall performance was excellent. In RS, 68 tonnes of seed were given for multiplication over 27 ha at the Agricultural Institute, Sokoloc and state farms Nevesinge and Rogatica.

The commercial small private potato farmers also made importations from Holland and continue to so on an annual basis, as they claim high yield is due to fresh importations for each crop. Potato seed is not stored.

These are attractive possibilities for small farmer groups to develop a seed industry. Sufficient cold/chill storage of high standard is available and unutilized (apart from imported banana) through the SAVA cooperative which would be sufficient to service the total RS requirements for stock seed.

1.11 Fertilizer Application

The fertilizer application rates are clearly aimed at maximization of production, which is a general feature of state farming. The high standards of crop production on these state farms is still being cited, which seems incompatible with their gradual slide towards bankruptcy. The response curve of inputs to product is not recognized; the restoration to profitability under private management must necessarily include due consideration of optimization of returns.

Compound fertilizers are mainly used, particularly 15/15/15. With the low N content, both urea and calcium ammonium nitrate are used as supplements. Heavy dosage rates are recommended for winter-sown crops, which must result in high losses of nutrients.

It is well recognized that with different rates of nitrogen application, the grain yield response is steep at lower increments (e.g. 0-30 or 30-60 kg/N/ha) and flattens out at higher (e.g. 100-120 and 120-150 kg/N/ha) rates. It is also common that 70-80% of the highest grain yield attained is obtained with 50% less of the "recommended" rate in a given situation. One must seriously question the current high rates of fertilizer being recommended. More attention is paid to the previous promotion of fertilizers *per se*, rather than to their efficient use. With the escalation in the cost of fertilizers, it has become imperative that fertilizers are used in a manner that gives the optimum return for investment. Cost benefit ratios of less than three will be totally unacceptable to small farmers.

A major problem exists for the farmer to gain advice on his fertilizer regimes and this is widely recognized. The development of response curves through on-farm testing must be top priority in any applied research programme. Useful data on individual soil analyses are available at each faculty/institute which, if consolidated on an areas basis, could provide the basis for detailed soil mapping which in turn could provide the basis for an on-farm testing programme to be implemented.

1.12 Food Processing

Food processing in RS remains in the state sector and has suffered severe setbacks through loss of regional and export markets. The largest unit, SAVA, has seen production output drop from 10,000 tonnes during 1972-92 to 2,000 tonnes in 1997. The unit is located in the heart of the more productive lowlands which previously supplied 70 percent of raw materials, of which 75 percent was from individual private farmers selling through cooperatives. Export markets absorbed 25 percent of finished product. The major problem has been the loss in confidence of growers and a chronic shortage of working capital for the farmer to enter into solid contracts.

Serious attempts are now being made to rebuild the confidence of growers by developing mutual trust, reducing employment levels from 600 to 300, and redeveloping markets and giving modest financial support to growers for berry fruits. The major production constraints are the cost of packaging (30 percent of total production costs) and sugar (60 percent for jams and compotes).

The factory now wishes to develop contracts with associations of growers, and negotiations are proceeding on pre-determined price arrangements for strawberries, previously a major crop in the area.

Producer/Market Linkages

Before the war, large-scale ex-social sector agro-kombinats and agro-processors, working together with farmer cooperatives, provided the market chain. The incentives to produce were largely from services and inputs supplied. Post-war circumstances have further weakened the social sector, exposing their inability to operate without heavy state support. Ex-social sector agro-processors face similar problems, due to seriously decreased production levels. Agro-processors must now compete with imported products which tend to be cheaper and of higher quality.

Some private sector agro-processing enterprises are now beginning to fill the vacuum left by the collapse of the ex-social sector. Small-scale animal feed mills, milk processing units and small food processors are emerging. Farmers are reluctant to sell to the previous buyers, as payments are delayed or not made. The net result has been a further retrenchment into subsistence farming, except in highly productive areas, in some cases with irrigation. Fruit and vegetables are being delivered by individual growers over large distances and sold on producer markets, which will in the short term continue to provide the major market outlets, together with personal retail contacts in the main population centres.

The rebuilding of accessible markets through competitive downstream value-added activities is a prerequisite to generating surplus production. The resource base is capable of responding, provided private producer organizations can be established with the necessary capital and management structure.

There are limitations imposed by farm size and various figures on holding size distribution and what could be a commercial farm have been presented, which suggests that only about 15 percent of farms could be considered for surplus production. This may be the case, were individual farmers to be supported. The possibilities of farmer groups entering the market chain seems to have been overlooked. Farms of 2 ha growing a plot of high-value berry fruit in cooperation with neighbours could be a highly profitable venture within the current depressed system. Shared costs of collection, administration and contract arrangements are no greater than those incurred by individual growers and have the advantage of being less risky in maintaining market presence and extension support.

Such an arrangement has been set up in Central Bosnia with great success and could provide a replicable model. No such initiatives are yet apparent in RS.

Animal Concentrate Feed

Previous reports indicate that there has been a long-term deficit in cereals and protein supplements for animal feed, which is consistent with the poor livestock performance.

Traditional animal feed was produced by state farms using their own products, supplemented with imported proteins, minerals and vitamins. Quality of compound feed was traditionally low.

The reduction in livestock numbers has produced a more positive feed balance, and RS is reported to be 70 percent self-sufficient in maize. However, with the reduction in area of oilseed crops, all protein is now imported from Croatia, Serbia and Hungary.

Recently, there has been a significant growth in small-scale milling/compounding mills, some attached to the Apoteka outlets. These operations can undercut the prices of state supplies and imported feeds, and appear to be highly profitable with readily available markets. A typical mill has a capacity of 300 t/month, with mixes directed to pig and poultry. Three labourers in one shift can compound 15 tonnes of product. All ingredients are imported. Most have been self-financing, starting with meagre capital resources and small capacities, developing on the basis of accrued profits. Their continued growth will depend largely on future tariffs on maize imports (the main ingredient). Present problems are mostly related to payment irregularities, particularly with exports to the Federation.

The various credit lines on offer are considered to have a high ceiling and an unacceptable pay-back time. Most units are expanding through reinvestment of profits.

1.13 Cooperatives

The current status of the cooperatives gives cause for concern, and serious attempts are being made to revise the basic structure and legal framework. The total demise of the Laktashi Coop, previously one of the largest in RS, highlights the weaknesses in the system which are endemic.

In mitigation, loss of export markets for pigs and cattle to Croatia and Italy, as a result of political isolation and sanctions, has had a serious effect. However, there has been a total breakdown in the system of contract growing through cooperatives, due to an erosion in confidence, lack of payment for products, unavailability of inputs, etc. This has had an upstream effect on their food processors. Political influence, poor planning and ineffective state management have been contributory factors. The cooperative is now moribund, but continues to derive a modest income from a highly efficient cold/chill store which is rented for storage of imported fruit.

Attempts are being made to restructure the cooperative movement and new legislation is being prepared.

A New Structure for the Cooperatives

In accordance with the new law on cooperatives (1997), the association membership is voluntary. Potential members will decide whether they need associations, they will determine their working plan and their business politics.

- *"The basic law is based on the principles of international cooperatives";*
- *"the principle of voluntary association into cooperatives is emphasized";*
- *"the cooperative is the economic organization of farmers and governed by its members";*

- *"all property of the cooperative is the private property of the cooperating members";*
- *"there is the possibility to develop farmer initiative in all branches of agriculture";*
- *"the dispossessed cooperatives' property will be restituted in accordance with the special law".*

The law is more valuable as the basis for development of a new organization of farmers. The ability of existing indebted cooperatives to reorganize, refinance and repair is doubtful, given the previous performance - reputation and trust.

1.14 Agricultural Research and Extension

Private farming enjoyed government support in former Yugoslavia only to the extent that it benefited the social or cooperative agro-industrial sub-sectors. Agricultural technology development was focused on large-scale farming and production maximization, paying insufficient heed to sustainability. While some private farmers adapted this technology to meet their needs, most learnt and applied technology which is now widely recognized as being inappropriate to a market economy. Although a body of appropriate technology exists and more can be gleaned from the practices of successful private farmers, there remains the need to restructure and re-orient the Agricultural Knowledge Services.

While there exists an awareness of new priorities, the severe constraints imposed by the shortage of public funds for research and the severe erosion in income have forced research/extension organizations to look for alternative sources of funds to survive the current crisis. A source of revenue still accrues from contract work for the kombinats but, with their increasing liquidity problems, researchers now realise that they must also look to providing services for the private sector. Research-operated land is now utilized for growing crops for sale, and their current involvement in seed production is substantial.

An appropriate technology would enable farmers to reduce costs, increase yield, improve quality and diversify production. Both public and private benefit would ensue, the latter already in evidence amongst a core group of more knowledgeable farmers. Instruments to support technology promotion are limited. A small extension arm of the agro-kombinats, some canton-based advisors and some elements of the scientific community constitute the main farmer information sources. These poorly wedded extension elements generally lack market or farm management focus, are short on appropriate technology and, in the public sector, are largely unaccountable to their farmer clients. A stimulus is required which would engage the farmer in constraint analysis and technology development, better employ the often under-utilized public and private extension resources to address identified needs, increase client accountability and, ultimately, transfer responsibility for the delivery of technical advice to the private sector.

II. ISSUES/CONSTRAINTS

2.1 Reconstruction

No major reconstruction has taken place in the agriculture sector in RS since the end of hostilities. During and after the war, FAO and a number of NGOs have contributed urgently required farm inputs such as seed, fertilizer, pesticides and hand tools, however in relatively small quantities. Bilateral aid has contributed animals and agricultural inputs to about 1,000 families in the Banja Luka area, and also fruit, vegetable and livestock inputs in the Srbinje region. In summary, while there has been some initial success with inputs, little has been achieved in the most war-damaged areas of RS to re-vitalize the agricultural economy, especially in RS municipalities located along the former confrontation line.

It is only recently that serious consideration is being given to the formulation of a strategic plan in a situation where public finances and institutional services have few resources to offer. The situation is further exacerbated by low farm gate prices, limited consumer demand, the high cost of inputs and cheap imports.

There is an almost total lack of factual information on the productivity, level of incomes, the resources and the major constraints of private farms. Within the framework of government policy and strategies, these data should provide the basis upon which agricultural development programmes in the individual sector are built. The only production data available are the crop yield estimates made by the statistical office. These deal only with broad averages and provide no basis for defining regional or farm system constraints and issues. To the extent that they are constraint-based at all, the current research programmes, for example, are based on data from the social sector where the available resources, and hence the constraints, bear little resemblance to those of the individual sector. Thus, while the level and productivity and the problems of the private sector are assumed to be known, this is no more than an assumption and is not based on any analysis or empirical data.

2.2 Self-Sufficiency

The priorities awarded by government to maintain, as far as possible, self-sufficiency in wheat production is understandable, given the fragile nature of the regional politics. However, it is incompatible with growth of the agricultural sector. The production of wheat/maize has been shown to be only marginally profitable, at best, under current production systems, and imported grains are significantly cheaper. Until the concept of promoting cropping systems with comparative advantage is fully accepted, the sector will continue to stagnate.

2.3 Farm Size

With over 50 percent of farms below the 2 ha size, there are limitations on cropping systems and, consequently, income that can be derived. If farmers are to produce surplus for sale, serious consideration will have to be given to crop diversification and intensification of present systems. Furthermore, competitiveness in production and markets will only be achieved through farmers cooperating to produce products of saleable quality.

2.4 The Cooperative Movement

The cooperative movement up until 1991 had abandoned cooperative principles and the organization had become an instrument of government politics which discarded the concept of private entrepreneurship in all sectors of business activity. The consequences are felt today and the reaction of farmers is that the cooperatives are an inefficient ideological creation from which farmers gain no economic benefit.

During the war, those cooperatives that continued to produce were not paid for delivered goods, and capital assets suffered varying degrees of damage which were not replaced, as donor assistance was directed exclusively to the private farmer.

The net result of this long period of mismanagement is that farmers were not interested in investing into cooperative production programmes, but rather to follow unstable, volatile agricultural markets and spread risk by growing small amounts of diverse products. The consequence is now that there are only a few private specialized producers.

2.5 Low Production

Crop and livestock production before the war were heavily subsidized and clearly unprofitable, due to inappropriate management techniques.

With the current system of production of cereals, a combination of high production costs and low yields produce marginal or even negative returns. Cultivation practices, particularly with wheat, are both unsuitable and costly. The seedbed conditions produced require high seed rates (100-270 kg/ha) to provide for acceptable plant populations and fertilizer application aims at maximum response. Costs of production could be reduced by 40 percent. Only about 20 percent of farmers use certified seed which, under optimum cultivation systems, would affect yield. However, with the current heavy weed/grass infestation, as a result of deep mouldboard ploughing, improvement in seed quality would have a minor effect. Selected gross margins (wheat, maize, soya bean), prepared by the working group, are attached. The analysis is based on inflated yields, but even accepting the derived figures for income, the gross margins are too low to be accepted by private farmers.

2.6 Credit

Substantial investments in appropriate agricultural machinery and agro-processing facilities are needed to recapitalize and revitalize the sector. These required investments cannot be financed solely from the income and resources of farmers and entrepreneurs. As existing commercial credit is limited and expensive, donor funded credit lines are needed (matched to demand) to accelerate the recovery process. In the medium term, financial sector reform is required to restore the confidence in the banking system and mobilize rural savings for investments in the economy.

2.7 Agricultural Machinery

The indications are that the capacity of existing post-war inventories were capable of maintaining pre-war levels of cultivation, seeding and harvesting. Machinery was undoubtedly lost as a result of war, but, set against progressive deterioration and lack of replacement as a direct result of socialist farming systems, conclusions are that the main issue

is not so much replacement of equipment due to war damage, but rather re-engineering of a totally unsatisfactory system of land cultivation equipment used pre-war.

2.8 Seed Supplies

Farmers in RS plant about 20 percent certified wheat seed and the rest is their own seed (without certificate). At state farms and cooperatives, certified seed accounts for about 90 percent. Yields on private farms are generally accepted to be about 20-30 percent lower.

The Agricultural Institute in Banja Luka has eleven wheat varieties of its own, as well as on-going activities for further improvements. With its current production (600 ha or 2,400 tonnes), the institute can meet about 20 percent (8,000-9,000 ha) of needs for farmers in Republika Srpska. The rest of certified seed (about 80 percent) comes from the Agricultural Institute in Novi Sad (Yugoslavia). The major blockage to increasing seed production generally is that a private seed-growing industry has not yet emerged to replace the previous state farm monopoly.

2.9 Animal Concentrate Feed

Previous reports indicate that there has been a long-term deficit in cereals and protein supplements for animal feeds, which is consistent with the poor livestock performance. Traditionally, animal feed was produced by state farms, using home-grown products, supplemented with imported proteins, minerals and vitamins. Quality of compound feed was low, with poor digestibility.

The recent reduction in livestock numbers has produced a more positive feed balance and RS is reported to be 70 percent self-sufficient in maize. However, with the reduction in area of oilseed crops, all protein is now imported. As the basis of recovery will be through the rehabilitation of production and marketing of livestock and products, an increase in area of industrial crops, supported by processing facilities, becomes a pressing issue.

2.10 Marketing Systems

The weakness of markets for farm products and farm inputs is attributable largely to the collapse of the social sector enterprises and as a result market surplus is negligible. Consumer preferences had limited impact on production decisions and product quality was low. The cooperatives and ex-social sector enterprises which provided farm inputs were managed under the same principles and government exerted heavy control on the provision of seeds and inputs.

The present individual marketing systems practised by surplus private growers is inefficient, high risk and encourages a volatile market. Until such time as a combined marketing strategy involving groups of individual producers can be put in place, the situation will continue to affect seriously farm incomes and sector development.

2.11 Summary

The most important constraints are structural and include the slow transfer of socially owned land and agro-industrial resources to the private sector, with resultant continued social sector dominance in agricultural processing and marketing and the lack of credit. Their

resolution will require substantial investment within the framework of a long-term agricultural sector strategy. In the shorter term, private agriculture could be substantially strengthened and the framework for major structural reforms established through a process of institutional restructuring, leading to increased client accountability and "ownership" of supporting government services, the promotion of private sector services and farmer groups, ministry staff and farmer training and reorientation to the market economy, and detailed sub-sectorial analysis, leading to improved policy formulation. Legislative reform is also necessary in the areas of rural land reform, restructuring of the extension service and the development of alternative financial services. However, it is considered that significant improvement can be achieved through relatively modest changes within a relatively short time frame, notwithstanding the recognized need for larger and longer-term investment in some instances.

The problems of the agricultural sector have their origins in previous policies which removed incentives for production, developed an inefficient distribution system and consumption patterns distorted by consumer subsidies. This system of farming was centrally controlled and concentrated on production targets with no consideration of costs. State farming often did not provide the sound experience and decision-making judgements which the private land owner now requires.

The financial support required to maintain inefficient agricultural production and distribution has contributed substantially to the current macro-economic problems. The state system has been unable to procure food supplies at realistic prices, due to the unacceptably high costs of production and inefficiencies of processing. Overall, this has had a demoralizing effect on the farming population, thereby stifling the initiative which needs to be developed to further the opportunities being opened up for private sector participation. The present gradual freeing of the market has produced further constraints for the private farmer; the high costs of production, credit and inputs, removal of subsidies and declining incomes, and the retention of monopoly elements in the marketing chain will require a serious reappraisal of current systems and considerable financial and technical support.

The recent policies encourage the development of private farms and the liberalization of state farms and processing units, but their success has been hampered by a lack of experience in running small and medium-sized enterprises, commercial management and production systems expertise. Without this expertise, the potential for developing an efficient and competitive agricultural sector will not be realized. Knowledge of agricultural economics and farm management systems is fragmentary, and research in agricultural marketing and policy analysis is almost totally absent. As a consequence, the support services do not have the expertise to respond to the break-up of the state procurement system, removal of price controls, trade restrictions, or the rationalization of credit - all of which are an integral part of the reform process.

The need for institution strengthening of the support services has been fully accepted and the ministry has focused on the fundamental problems which need to be resolved. With respect to research services, these can be enunciated as:

- Research lacks a coherent policy and its role is unclear; consequently, no priorities have been set which directly reflect producer problems or opportunities for improvement.

- The entrenched research culture and its strictly disciplinary approach to academic lines of research predominate. There has been a reluctance to accept any responsibility for on-farm programmes or subjecting of research findings to financial analyses.

- Research workers have been unable to identify the constraints and potential of different farming systems as a basis for developing relevant technologies. This requires a multidisciplinary approach, directed to improving integrated farming systems, applicable to the three specific ecological zones.

There is no justification for mounting separate research and seed production programmes for RS and the Federation, as the problems encountered and requirements by both entities are similar. It is unlikely that donor response to duplication of services would be forthcoming. The strategy proposed therefore assumes that a joint approach would be agreed upon.

In the reorganization of the extension services, it must be realized that the technologies devised by the social farms are inappropriate to the needs of the private farms. Many principles of production have been inherited from the social farming systems and are widely practised by small farmers. Cultivation systems with inappropriate ancillary equipment, over-application of fertilizer and inappropriate times of application, high levels of unbalanced concentrates fed to housed cattle, and general high input production systems, are having an increasingly serious effect on small farm incomes. The current advice given is therefore technically unsound, financially non-viable and high risk. The rate at which the transition required can be effected remains questionable, as a complete reversal of production technologies related to profitability of farming systems is now required.

In the past, almost all that farmers produced could be sold, almost irrespective of quality, to social sector enterprises at reasonable prices, most of which were supported either directly or indirectly by government subsidies. Comparatively small quantities only were sold directly to the market. Government agricultural policy was, and continues to be, to increase total output; this policy continues to be the philosophy guiding all support services to agriculture and especially to technological development. Farmers interests increasingly focus on security, income and family well-being.

Furthermore, the broad government policies have not been translated into strategic priorities. The competitive advantages of various alternative cropping systems or products have not been analysed. For many crops for which technical conditions are highly suitable, particularly the oil crops, production costs are above import parity prices. Restricted production credit further leads to the conclusion that a general strategy of reducing production costs must be the main priority which has yet to be put in place.

Education, research, extension and agri-business now needs to focus on how to improve farm family income, as opposed to just improving production. This requires a much sharper focus on the economics of technology and other investments, and on its risk acceptability to small farmers.

III. STRATEGY RESPONSE/DONOR PACKAGES

The overall objective of the strategy is to support increased production and profitability of private farmers in a cost-effective manner.

Given the many constraints facing sector growth at the present period - shortage of public funds, restrictive farm size, limited resource base and the required change to a market economy - the strategy must be carefully phased to give due consideration to the absorptive capability of the government and farmers, together with the areas of support, where donors are most likely to respond.

The strategy for crops, fruits and vegetables therefore focuses on the formulation of a five-year action programme to provide for immediate impact. This Short-Term Action Programme (STAP) is based on a preliminary identification of areas of comparative advantage within the resource base, potential profitability and market outlets.

A STAP within an overall medium strategy (ten years) is clearly required to consolidate and build upon emergency activities carried out to address the most serious consequences of war damage. The STAP should concentrate now on addressing those issues and bottlenecks which became endemic in the pre-war social agenda for agricultural production. Whilst some progress has been made to amend policies and legislation pertaining to state farms, cooperatives, state ownership of food processing facilities and cross-border trade restrictions, these initiatives are moving slowly. The STAP therefore concentrates on the introduction of free market activities and supports the initiatives already evident through individual entrepreneurship.

Implicit in this approach, given the low level of public funds and institutional support which can be expected, is to concentrate on areas where the resource base can support more profitable agricultural production, crop diversification and intensification. Furthermore, within these areas to concentrate on commercial farmers - farmers capable of producing a surplus. The objective is to create a management/producer structure which can be replicated on the basis of success and profit generation for such an association of producers.

3.1 The State Farm Structure

State farms in RS cover only five percent of the land area, but nevertheless have a valuable asset in infrastructure, livestock units, feed mills, farm machinery and a trained technical manpower resource (albeit for large-scale farming). The state farmers are plagued by the same problems evident throughout Eastern Europe and the CIS. In RS the core activity is livestock-based, but in common with similarly structured units, they are unable to produce sufficient feed, particularly protein to satisfy the demand. The Mladen Stojanovich Unit grows extensive areas of maize on a sand-based, highly permeable soil, which is totally unsuited for the crop. The costs of production are seriously in excess of import parity prices. All proteins are imported.

State farms which cannot be privatized are heading towards bankruptcy; urgent action is now recommended to privatize, lease or rent those activities within the system which have clear comparative advantage and which are potentially profitable. Such activities would include seed production, fodder production, cattle breeding and fruit planting material.

3.2 Cultural Practices

Tillage practices are determined by the equipment available and are totally unsuited for land preparation. The current practices of deep mouldboard ploughing must be replaced by ripping to break the plough pan developed over 30 years. The reduced tillage system using chisel ploughs and tine cultivation (non-inversion of the soil) will provide for effective weed control and optimum seedbed preparation catering for rainfall absorption. This equipment is currently unknown in RS and donors have missed the opportunity of introducing and demonstrating it under the package grants. Again, there is a resistance to change, and only through demonstration, overseas visits and the acceptance of gross margin analysis can change be instituted. It is absolute priority that cultivation systems be improved. This will immediately reduce the costs of land preparation by at least 40 percent and reduce seeding rates by 100 percent.

Seed rates for wheat are excessive and, due to a combination of factors, of which the standard of the seed bed and poor seeding equipment are the major causes. Fertilizer rates are based on state farm practices for maximization of production, rather than optimization of profit. Compound fertilizers are used which are unbalanced for requirements, being low in phosphate, for which the soils generally have a high requirement. Soil acidity problems are widely reported by research workers. Research staff recommend liming soils below pH 4.5, but financial returns are not known. Alternative land use patterns on acid soils have not yet been considered. It would be possible, with existing knowledge, to define a package of practices which would provide for significant increases in return. However, as with tillage, there is a resistance to change.

3.2 Crop Diversification

Cereals

Rainfed wheat is only marginally profitable in many areas of RS. Proposals have been prepared for introduction of improved barley and oat varieties from the Institute of Field and Vegetable Crops, Novi Sad. Preliminary testing has shown that introduced cultivars can provide for profitable yield levels in certain environments of RS, particularly the hilly areas. Barley and oats are suitable in many food products, such as baked goods, pasta and breakfast cereals. In yeast-leavened breads, barley flours can be substituted for part of the wheat flour.

Oats are tolerant to soil acidity (70 percent of RS soils give an acid reaction), have low nutrient requirements and an excellent composition of amino-acids.

The current area of rye is about 2,500 ha. The main reason which limits the rye area in RS is the lack of quality and high yield. Farmers in mountain areas grow local rye varieties with average yields of 2.8 t/ha. There has been no breeding or varietal introduction.

Rye is known to be agronomically suited to the mountain region (agro-ecological zone three) at 600 m and above. It is tolerant to marginal conditions and low inputs. Alternatives to wheat have been overlooked, largely because of consumer demand for white bread.

Industrial Crops

Industrial crops have not featured to any extent in RS cropping patterns and are now even less important since the war, though soya bean is showing signs of recovery. Most oilseed mills are in RS, but are seriously short of raw material.

The continental area is very suitable for a range of cash crops, such as sunflower, soya and rape. These crops provided an important source of income for the kombinats who controlled processing. With increasing inefficiencies and cash flow problems, the processors have been unable to pay private farmers for crops delivered, and consequently all crops have fallen out of the cropping system. Apart from loss of income from these crops, there is also a serious deficit in protein supplements for livestock. Oilseed crops could play an important role in providing a break to cereal cropping patterns, thus checking disease and pest build-up.

The future lies in viable private sector processing enterprises, integrated with small feed mills, which would provide serious alternatives for diversification into soya, sunflower and rape, and provide for import replacement. The suitability of soya and sunflower for growing over much of the lowland areas raises the possibility of the introduction of small-scale, low-cost screw type oil expression mills. These units are inefficient for oil extraction, but conversely provide a high oil content cake. Most small millers also import edible oils to enhance the value of the low-fat (solvent extraction) protein meals available from neighbouring countries.

Fodder Crops

Fodder crops (lucerne, alfalfa, clovers, trefoils, etc.) are ideally suited to the agro-ecology, particularly the heavier soils. They could provide the “legume break” within a cereal dominated cropping pattern. Production is showing signs of increase and some excellent planting material is available through the Banja Luka Research Institute. Major constraints are a lack of forage harvesting and baling equipment and depressed demand, due to reduced cattle numbers.

Medium-term possibilities for specialized forage growers are attractive. Market opportunities will develop with increasing cattle numbers, but also to support the vast potential for over-winter fodder for mountain grazing, particularly sheep, where the promotion of the sheep’s cheese industry has clear export potential.

Medicinal Plants

The potential for the collection of medicinal plants for primary processing and export was beginning to be exploited before the war. These high-value crops would have ready access to world markets for medicines, food additives and cosmetics. Areas above 1,000 m, with a continental/Mediterranean climate, provide the optimum eco-climate. The absence of the use of agro-chemicals is a further advantage.

Previous trade involved collection of wild plants, but pre-war trials on cultivated species were successful, providing a more reliable source of raw material. The collection and processing was organized through the state system, but the industry is more suited to small collection units and extraction plants, which fits well with the proposed structure for the small private association of farmers. The re-establishment of the industry will rely on the

ability to develop the necessary skills and manpower for collection, which would also provide a valuable contribution to developing rural employment. There are strong grounds for supporting the modest investment required to further the crop diversification programme, provide for value added and to build on previously established export markets.

Investment required would be for small extraction units owned by farmers associations, training and market research.

3.3 Crop Intensification

Irrigation

Tentative estimates of water balances show that over 60 percent of RS has water deficits affecting crop yields. These deficits occur mostly in July and range from 200-400 mm. Although summer drought is a factor affecting yields in the cereal growing areas (quoted as one in four years), the returns to irrigation are unknown.

Irrigated land is restricted to vegetable growing, mostly from groundwater; river pumping is carried out on the more developed farms which have access to surface water and in the Mediterranean zone for high cash value crops.

RS has significant and attractive potential for the exploitation of its water resources, both groundwater and run of the river. World Bank assisted draining schemes reclaimed 110,000 ha through primary pumping schemes and construction of 500 km of canals. Some 19,000 ha of this land are suitable for irrigation from June to September. Blocks have been laid out on the basis of 12 farmers on 25-30 ha.

On-farm irrigation costs were calculated, on the basis of 3 ha holdings, with a moveable pumping system and 3 kW pump, at some DM6,500. Original mapping suggests that about 16,000 ha could be brought under intensified production with high-value crops. Tentative calculations on returns to investment exceed 40 percent (assuming vegetable and berry fruit growing).

The RS must initiate a long-term programme for crop diversification and intensification, for which substantial resources exist with potential for development at low cost. Irrigation must play a major role in this strategy, which could move progressively, based on the development of farmer associations supported by modest credit.

Plastic Greenhouses

The experience of supplying plastic greenhouses to returning refugees through donor assistance has been very successful. These have been used (with technical assistance support) for a wide range of activities, including nursery production, berries and early vegetables. The houses were established (10 m x 5 m) at a capital cost of DM900/unit. The benefits were accrued through autumn-spring production of product which commanded a high price. This low-cost approach to generating early income for emergent farm production associations should be a priority.

Intercropping of Fruit Orchards

It is clear that a progressive replanting programme of fruit orchards is urgently required. Proposals are made for supply of planting material, and it is predicted that there will be a positive response from farmers. To cater for providing a farm income during the establishment period until the crop comes into bearing, it is recommended that a replanting credit package include provision for intercropping trees with forage legumes. This would have the advantage of cash income from sale of fodder, weed control and nutrient added.

3.4 Area and Yield Projections

Yield projections given by the working groups are extremely ambitious and suggest an over 100 percent increase over the total area by the year 2010. The projections are based largely on response to high dosage rates of fertilizer (maximization of production) and an assumption that all supporting services, input supply, improved seed and credit facilities, will be in place and freely available.

A more pragmatic approach is necessary by addressing the major production constraints and concentrating the very limited resources in areas which will provide the greatest benefit over the short term. The target group should be the five-hectare and above farms.

With cereals, the most important constraints are the cultivation techniques used and, with a continuing drive towards self-sufficiency wheat, in particular and in some cases maize, are being grown in areas marginal to both crops.

Cultivation practices must be modified before any responses to added fertilizer will be apparent. Increase in fertilizer application under current cultural practices will not provide profitable incremental yield. The responses to optimum tillage practices would be both in yield (estimated at 30 percent) and significant reduction in the costs of land preparation (estimated at 40 percent). Furthermore, the reliability of cropping during periods of insufficient rainfall will be improved, as the crop can draw on stored moisture within the soil profile.

With the removal of the tillage constraint, fertilizer responses will undoubtedly provide for significant yield increments (estimated at 25 percent) up to the level of optimization of profit. This level must be defined on the basis of on-farm testing and the derivation of response curves. Similarly, responses to improved seed should provide a 25 percent increase in yield.

Serious consideration must be given to the diversification from wheat in areas which are more suited to other cereals (rye, oats and barley) and the industrial oil crops.

A tentative estimate of land area diversification and projected yields is presented in Table 12. The progress in year 2008 assumes that 50 percent of target farmers have accepted the priority package and that basic extension, credit and processing facilities are in place to service this category.

Table 12: Crop Diversification and Projected Yields

	1998		2008		
	Current Area (ha)	Yield (t/h)	Projected Area (ha)	Yield[1/] (t/ha)	Assumptions & Remarks
Wheat	88,000	3.0	73,600	6.0	– Diversification in marginal areas – Tillage practices – Certified seed – Optimum fertilizer application
Maize	150,000	3.0	136,000	5.0	– Tillage practices – Improved imported hybrids – Optimum fertilizer application
Rye	2,500	2.8	5,000	3.8	– Tillage practices – Improved introduced cultivars and certified seed – Optimum fertilizer application
Oats	22,500	1.9	30,000	3.2	– Tillage practices – Improved introduced cultivars and certified seed – Optimum fertilizer application
Barley	10,600	2.3	15,000	3.0	– Tillage practices – Improved introduced cultivars and certified seed – Optimum fertilizer application
Soya Bean }		2.1	10,000	3.3	– Tillage practices
}	7,000				– Improved introduced cultivars and
Sunflower }		1.64	3,000	3.0	certified seed – Optimum fertilizer application
Rape	-	-	1,000	2.8	– Tillage practices – Improved introduced cultivars and certified seed – Optimum fertilizer application
Potatoes	23,800	6.0	15,000	15.0	– Excluding potatoes from slopes above 25% and replacement with fruit trees – Elite imported seed – Tillage practices – Optimum fertilizer application including FYM – Effective seed grading and cool store

[1/] Assume: 50% of commercial farmers with support services accepting packages, i.e. about 25% of land area.

Priority must also be given to developing increased areas under irrigation. Farmers would respond positively if suitable credits were available, as the benefits are fully recognized. Low-cost irrigation development could move rapidly and it is projected that by year 2008 it would be realistic to assume a further 5,000 ha under control. The benefits are known to be high, both in yields achievable and increase in cropping intensity. The most likely crop development will be vegetables, fruit and berry fruit, soya bean, forages and seed production.

A stimulus for private seed production is urgently required. The local team suggests that a seed production area of some 170,000 ha will eventually be necessary. Assuming a three-year replacement for cereals (except hybrid maize), a target of 20,000 ha by year 2008 would be more realistic and within the organizational capability of the ministry.

The rehabilitation and expansion of fruit areas provides for the most attractive investment in the short term. Expansion of area should initially replace potatoes where they are currently being grown on unacceptable slopes. Fruit trees would be an integral part of the erosion control measures. This development will be constrained mostly by the time required for importation of improved planting material (suited to current export markets) and the expansion of nursery facilities. As it has been agreed that the private farmers should be responsible, a major training and supervision input will be required, backed by necessary government controls. It would be realistic to assume production of about 300,000 seedlings by the year 2008.

Similarly, rehabilitation and expansion of the berry fruit industry must be a priority. The establishment of ten hectares of nursery within five years would be achievable and would provide for commercial production on 800 ha. The culture of berry fruit is known and the areas for development have been identified.

3.5 The Seeds Industry

There is no justification for RS to set up a plant breeding facility, as the regional facilities have adequate capability. However, priority should be given to field testing and verification of materials introduced, both from regional stations and CGIAR world collections. The mission award this approach a high priority for the Banja Luka Institute. Financial support will be necessary, mainly for upgrading their capacity for seed grading, dressing and preparation for retail outlets.

Seed production has been the preserve of the state farms and continues to provide their major source of income. Large-scale seed production which can be supervized and inspected is logical. During the privatization process, seed production should continue to be carried out on state farm land, but under private production management and supported by government inspection services.

The RS estimates of seed requirements are shown in Table 13, which gives an indication of the capacity required for a sustainable seeds industry (seed rates are seriously questioned).

Table 13: Planned Area, Seed Rate, Quantity of Seed necessary for Planting

Crop	Area (ha)	Seed Rate kg/ha	Seed Requirements
Wheat	43,000	270	11,550
Barley	5,000	200	1,000
Oats	20,000	160	3,200
Rye	1,500	220	330
Maize Hybrids	80,000	25	2,000
Soya Bean	5,000	110	550
Trefoils	9,000	30	270
Grass	1,000	20	20
Total	174,500		43,890

Source: Crop, Fruit and Vegetable Production - Working Group

Whilst production of higher categories of seed, e.g. parental lines of maize hybrids, should continue to be produced by an extended facility at the research institute, production of stock seed should now be transferred to private farmers under the supervision/inspection of the institute.

Farmers should first be registered on the basis of capability, availability of suitable machinery and conform to specific conditions (altitude, isolation and soil conditions). The Agricultural Institute would require strengthening, in staff (supervision and training), vehicles, harvesting equipment and expansion of the existing small-scale seed processing unit.

3.6 Farm Machinery

The RS authorities estimate a loss of 40 percent of pre-war farm machinery, which was translated (from a previously over-mechanized situation) into an urgent requirement for 5,700 tractors, 1,800 combines and 13,000 other agricultural machines. Whilst these figures are not disputed, replacement alone may not provide the optimum benefits. The organization of machinery utilization and immediate attention to the importation of cultivation equipment suited for reduced tillage systems must run in parallel. The intensity and power requirements of current land preparation systems could be reduced by 50 percent to the benefit of gross margin and profitability, particularly of cereal growing.

The main problem lies with the lack of suitable ancillary cultivation equipment. Tillage equipment was produced for use on the extensive farming systems of the kombinats and has little relevance to the requirements of the privately operated farm.

The traditional and universally used tillage systems consist of mouldboard ploughing (20 -30 cm) followed by disc harrowing. Over years, this has resulted in the creation of soil pans, often impermeable, and deterioration of surface structures by disking during dry conditions resulting in soil capping. While rainfall appears in most cases to be sufficient for crop growth, the storage of moisture is limited both by a restricted absorptive profile or run-off due to soil capping. Immediate yield responses to ripping (chisel ploughing) and the substitution of scarifying for disc harrowing could be expected.

Efforts must now be made to establish a solid policy framework for agricultural mechanization and other key investments to assist agriculture to evolve into a competitive

and profitable sector through joint small farmer enterprises, based on cropping systems with comparative advantage.

Due to the small farm size, there is little justification for individual farmers to own machinery, unless they are involved in intensive production of high-value crops or are prepared to share use of the equipment with others. Multi-farm use, mostly through a system of owner-operators contracting for machinery services to neighbours, friends and relatives, is likely to evolve. The alternative is a system where private farmer associations could be established on the basis of joint ownership and operated on a cooperative basis.

An internal market for used equipment should be encouraged in the interests of creating a flow of equipment between various levels of customers, a source of cheap machinery for smaller farmers and a means for larger farmers to upgrade their equipment. This is part of the normal function of a farm machinery dealer.

World-wide, there is a considerable flow of second-hand tractors between highly industrialized and mechanized countries and those less able to supply themselves with expensive new machines. It would be entirely feasible to enter this trade.

Various options are available:

(a) tractors in ex-farm condition for immediate re-sale to RS farmers;
(b) tractors overhauled in the country of origin, but without any guarantees provided;
(c) tractors rebuilt to original or updated specifications in the country of origin;
(d) tractors in ex-farm condition for overhaul or re-build locally.

Option (d) is possibly the best choice, since the cost of the imported units would be minimized and the maximum of value added, together with the opportunity of creating employment and experience in rebuilding machines. The establishment of such a system might be left to the manufacturers eventually installing distribution arrangements.

The cost advantage of the existing machinery is due to its zero capital depreciation and interest cost, which more than compensates for the higher operation and maintenance (O&M) cost. Consequently, if used tractors at low capital cost could be imported, cost advantages would be considerable if compared to new machinery. However, care should be taken in the selection of makes and types of used tractors, in order to allow a considerable portion of the necessary spare parts to be manufactured locally, so as to maintain cost advantages on the maintenance of the machines. Importation of used tractors and implements should be done through the private distributor system.

The establishment of a private sector farm machinery distribution system will undoubtedly take several years. There will be an ongoing need for technical assistance to the ministry to advise on mechanization policy and strategy and promote the development of private sector distributors, dealers and repair shops.

There is considerable external funding targeted at the agricultural mechanization subsector. If effective coordination between agencies is to be achieved, there will need to be a coordinator/advisor to assist government. Consultant support will also be required in company formation, company law, ancillary equipment, design and financial management.

The limited opportunities in the short and medium term for recouping an investment in distribution facilities of the size required are unlikely to attract international machinery manufacturers. The Phare programme could be approached to provide financial assistance in the form of an investment grant, by which means the manufacturer might expect to cover part of the investment in a reasonably short period. A maximum of ε600,000 is allocated to these government grants - to be provided to two or three farm machinery principals.

The dramatic change to a private sector farm machinery distribution requires an understanding of western commercial procedures that is totally different from that currently operating. Senior officials in the ministry will require exposure to procedures that can only be found by visiting countries where the system is well established. The programme should therefore consider a series of overseas study tours for relevant personnel who are intimately involved in the re-alignment of government strategy in respect to agricultural mechanization.

The study tours would be organized in close cooperation with farm machinery manufacturers in the European Community, in order to gain an understanding of the relationship between farm machinery manufacturer, distributor and dealer. Particular emphasis would be placed on service and support that the system provides to their respective companies.

3.7 Farmers Associations

The major problem facing RS private farmers is the small farm size with fragmented holdings. Under this constraint, farmers still operate individually under a high-risk situation, particularly regarding the marketing of any surplus production. In response to this risk element, farmers will concentrate on cereals, together with a range of alternate produce, vegetable and fruit, through which they hope to find a market niche for a small quantity of low quality product.

Individual farmers are too small to justify machinery purchase, they are not eligible for credit, as their repayment capacity is low and they have little influence in the market place, nor do they have access to advisory services.

The fundamental need is now clearly to promote associations of growers, based on a crop or crop system, which has comparative advantage and which can provide for adequate returns to inputs and labour. Initially, reliable contracts should be sought with processors or wholesale markets. The establishment of viable producer associations would provide the vehicle for a machinery services facility, group production credit, marketing and value-added farm gate, and a focus for advisory support.

A key factor which will determine the success of the farmers association (or the rehabilitation of a cooperative) will be the identification of the basic core production activity around which members can join and contribute.

There is sufficient information derived from market demand, crops with comparative advantage in a specific environment and gross margin analysis data to identify profitable core activities, upon which associations of growers could be initiated.

Of immediate priority are:

- berry fruits,
- medicinal plants,
- forage production,
- protein cakes and oils with on-farm processing,
- fruits (mainly apples, pears),
- small-scale dairy primary collection units,
- sheep's cheese,
- seed production (potatoes/forages).

An association of ten farmers with a holding size of 3 ha (a potential surplus producer) would effectively consolidate a production area of some 30 ha, suitable for optimum utilization of a machinery package with excess capacity for contract hire. A ten-farmer group could produce commercial quantities of guaranteed quality to provide for contracts to wholesalers or processors. Specific extension advice could be applied.

The concept would be attractive to donors, as it is exclusively private sector-oriented, could provide a more effective utilization of farm machinery and other production credit lines and cater for value added at farm gate.

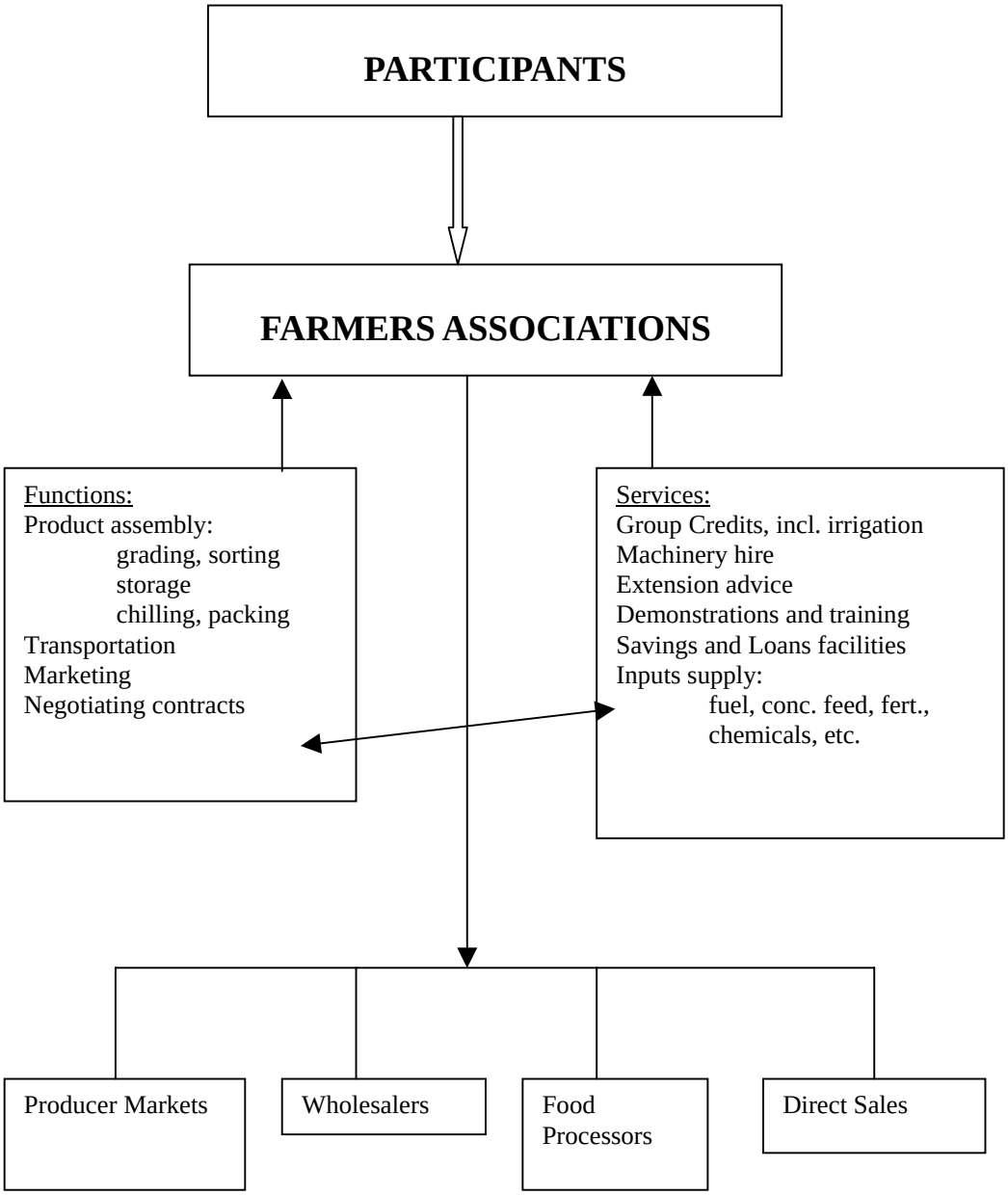
A comprehensive technical assistance package would be necessary to support the ministry and public sector state farm/cooperative officials wishing to move to private sector activities. This technical assistance should cover:

- facilitators to introduce the concept,
- identification of specific opportunities,
- formation of associations,
- production of business plans,
- assistance to establish production contracts,
- assistance to identify and organize credit lines,
- training of extension agents in specific commodity or business enterprises,
- training of association management in book-keeping, procurement and contracting.

The association should not be constrained by any new or derived cooperative law. The registration of an association can be effective as a private company for which legislation already exists.

CHART

Farmers Associations



3.8 Agricultural Extension

The farmers of RS are neither a homogenous group, nor are their requirements. However, with the limited staffing resources available, it is not possible to give cover to all farmers. It is possible that the non-viable small farmers will sell or rent their land. There is therefore a strong rationale to focus extension efforts on the more advanced farmers who intend to expand. Knowledge on the present situation and performance of these farmers will be crucial to the design and extension strategies and activities.

There is a budget constraint and care must be taken to control recurrent costs. These cost constraints will prevent any increase in staff numbers, yet farmer contact must be increased, operational efficiency must also be improved and effective delivery of relevant packages given priority. It has been suggested that Farm Service Extension Units (FSEU) be established in each of the three agro-ecological zones to operate as the core resource centre for the rural community. With limited staff resources, the service would have to operate through farmer groups and use production/marketing/management associations as their primary contacts.

Extension support services to individual farmers would have to be built through the private sector, working in co-operation with the FSEUs and utilizing their technical resources.

The strategies for achieving these objectives would include:

- the development of a decentralized information data base for typical farm operations, productivity and income levels upon which extension programmes can be devised;
- the derivation of a short-term action programme, based on the identification of major problems and constraints facing the farmer;
- encouraging the participation of farmers in the refining of zonal-based farm system constraint analysis;
- introducing financial and economic criteria into the setting of extension recommendations and identifying adaptive research programmes aimed at improving the profitability of private farms.

A retraining programme should be supported for all extension officers. The staff would undertake a short course designed to familiarize themselves with the role and activities of the extension service. The course should be conducted by senior extension staff. Trainers should be trained through a course, designed and conducted by an internationally recruited consultant.

The programme should also support a regular annual in-service training programme for extension service staff. Extension staff should participate in a one-week training course at the zonal level, designed to update their knowledge and skills, based on the extension themes developed.

Specialist training should, in addition, be provided to research and extension staff who would participate in the research sub-project proposal exercises. This training should focus on participatory farm system constraint analysis, research-extension coordination, defining adaptive research priorities and the design and evaluation of on-farm trial and demonstration systems. Additional specialist training should be provided to extension staff in using mass media including radio, the press and TV.

Short-term overseas training should be supported for selected staff for three months each at appropriate training institutions to gain experience in training organization, skill analysis and extension methods and administration.

Support to Farmer Associations

The extension services should encourage farmers to form self-help groups with a common interest in technology development, bulk supply of inputs, product marketing, or in sharing equipment, essentially by (i) limiting time spent with individual farmers, (ii) offering legal and administrative information/advice on formal group formation; and (iii) providing technical and managerial training to group leaders. Such training should include both informal training, extended during visits or seminars and formal training, which should be organized at the national level and involve guest speakers from agribusiness.

Private farm production financing has been dominated by direct credits, managed by the former social sector agro-industrial complex. Commercial banks have limited knowledge of private farm investment opportunities or procedures and afford this sector a low investment priority. Nor is the size or distribution of their branch networks conducive to rural lending. Also, uncertainty over agricultural policy has increased the perceived risk in agricultural lending.

3.9 Agricultural Credit

Almost all of the finance available for the agriculture sector is provided by international donors. Current donor credit programmes operate at two levels: larger loans of DM100,000 to DM1 million and above for small to medium-scale enterprises (World Bank, USAID) and NGO-based micro-credit programmes, established under a World Bank-financed project, which provide loans of up to DM10,000 for micro-enterprise investments by returning refugees and displaced people. There is therefore a vacuum in terms of access to loans of more than DM10,000, but less than DM100,000, which seems to be the order of financial support most required.

Farmers and small-scale enterprises are most concerned at the short repayment terms of three years. This creates short-term cash flow problems. The micro-credit programmes are limited to two years repayment with a 10-30 percent interest rate. Serious consideration is needed either to allowing a grace period or extending the terms of these loans if they are to be considered viable.

In general, the performance of commercial banks active in the agricultural sector (mostly based on donor-funded credit lines) is far from satisfactory.

Farmers now operate on a cash economy, and modest profits are held in cash. Whilst the reluctance to use the banking system is justifiable, there is an alternative option through farm associations to develop a rudimentary savings and loans operation within their own

association. A grass roots mobilization of savings is a fundamental factor in the reconstruction of the national banking system.

3.10 Research

The potential for development of the private farming sector is large, since it covers most of the arable land and currently has low productivity. In addition: (a) private farms (being typically small in size) have reserves of under utilized labour; (b) much of the new technology could, in many cases, be applied on these farms with minimal adaptation; and (c) when given technical assistance, credits, markets and irrigation, the private farmer has demonstrated the ability to achieve high levels of productivity. The pace and extent of private farm sector modernization will depend largely on the policy framework devised to progressively: (i) increase investments in technically sound and cost-effective packages, including improved cattle feeding systems, farm mechanization, etc.; (ii) channel more technical support services into the sector; (iii) consolidate individual land holdings and increase farm sizes; and (iv) adapt to the evolving market economy.

The main objective of the programme would be to develop a research service responsive to serving the requirements of private farm families now operating in a market economy. More specific objectives would be:

- to initiate and sustain a process where past academic and production orientated research is replaced by a more analytical, economic and producer constraint orientated approach;
- to establish effective participation of producers in identifying their priorities for research support;
- to introduce the rational planning of research projects to resolve readily identifiable constraints at farm level, with due consideration of the total socio-economic farm system;
- to provide for a system which can generate research sub-projects, award priorities and effectively implement them;
- to develop a conducive operating environment and strong linkage between research and extension through which technology transfer and information flow maintain a relevance to farmers' needs;
- to better equip the research services to adjust to the requirements of private farming needs and to enable them to implement contract sub-projects at field level.

In developing strategies for achieving these objectives, consideration should be given to:

- the restructuring of research policy planning and programming through the establishment of an Agricultural Research Council (ARC) and Zonal Farm Service Extension Units;
- providing reorientation training for research workers to generate and implement programmes which will provide for short-term improvement in current farming systems, procedures and profits;
- the introduction of basic criteria and guidelines to assist scientists in the formulation of priority sub-projects;
- providing the necessary equipment and operating costs to enable scientists to effectively carry out these sub-projects;
- improving cooperation between research and through farming systems constraint analysis surveys as a basis for identifying research sub-projects.

In Appendix 2, Priority Programmes, draft outlines are provided for research programmes in the areas of: soil management fertilizer responses, tillage systems, farming systems research and a study on industrial crops.

Zonal Farm Services Extension Units (FSEU)

Given the substantial differences in topography, soils, climate (and consequently cropping patterns) throughout RS, these various agro-ecological zones require individual attention in the technical formulation and implementation of research and extension programmes. This diversity between zones, but with strong intra-zonal homogeneity, would justify a zonal level approach, as research programmes will be based on local constraint analysis, farming systems and farmer participation, together with the need to closely monitor farm systems developed.

Adaptation of Existing Technology

A five-year programme would be required to release some of the benefits which would accrue through the redirection of the research organization and the implementation of an applied research programme. Initially, it is suggested that existing research knowledge and dispersed results be reviewed, packaged and demonstrated, in order to provide for initial advisory packages for the extension service which can build farmer confidence in the system.

Information on fertilizer responses is available from various sources which, if consolidated with the substantial data available from soil analysis over all zones, could provide the basis of preliminary fertilizer recommendations which could be expected to improve crop gross margins.

Soil compaction has been identified as a serious problem, and immediate responses to ripping alone would be guaranteed to provide for more favourable crop/water relationships and improved yield.

The importation of hybrid seed for maize could provide for further immediate yield increases.

Training

A reorientation of research staff covering the new research structure, and operational changes to accelerate the process of changing attitudes and thought processes is proposed. Research workers should be introduced to the importance of determining the potential economic benefits in the selection of research programmes and be responsive to concentrating on practical problems. The re-training would also develop the ability to identify the major constraints, through a participative process, rather than the possible constraints within their own discipline. This reorientation should be carried out by trained trainers, and an overseas specialist should be invited to both introduce the new concepts and give credibility to the philosophies being promoted. Candidates should be provided with a study tour to visit overseas research stations where these changes have been established (e.g. Rothamstead United Kingdom).

Technical Assistance (TA)

The Research Council. The effective design and evaluation of the research programme would rely heavily on the performance of the ARC. The concepts being introduced for project prioritization and the radical changes to critically concentrate on national programmes through a multidisciplinary approach with strong economic evaluation inputs will need expert planning assistance, particularly in the first year of operation. Technical assistance should be applied to assist in the introduction of the system, the review and selection of the first-year projects and their supervision during the first year's growing season. It is proposed that a senior scientist with experience in the functioning of research councils be recruited for a short-term assignment.

Study Tours

There is clearly an entrenched attitude amongst some senior government officials supporting the continuation of socialist farming techniques. This can only be addressed through demonstration of improved systems, supported by study tours. Overseas visits have proved to be a very effective tool in changing the "mind set" widespread in the Socialist countries. However, great care is needed in the selection of visits, bearing in mind that current European large-scale, heavily subsidized, high technology farming is not an appropriate training ground for small-scale agricultural systems.

3.11 Donor Financing

There is strong criticism from some quarters that donors rigidly oppose the financing of current state-run enterprises, particularly cooperatives. This is not entirely justified, as lines of credit have been negotiated for specific activities within the system which have potential for markets and profitable returns, e.g.:

- berry fruits,
- cold storage,
- greenhouses,
- medicinal herbs,
- cattle fattening,
- slaughterhouses.

The effectiveness of these credit lines has been contingent on the preparation of a business plan which clearly outlines the management structure, staffing rates, capital and operating requirements and potential returns. The approach is therefore a privatization of an activity which has comparative advantage to member growers and is a replicable concept, particularly in the planning of privatization of state farms.

However, donors will maintain the position that financing opportunities will be developed through the initiative of the farmers themselves and it is certain that technical assistance would be forthcoming to assist producers to develop business plans on the basis of emergent entrepreneurship. The donor programme, in the short term, is therefore recommended to concentrate on technical assistance to further support a basic psychological change to support profitable farming from the bottom up.

APPENDIX 1

PRIORITY PROGRAMMES

1.1 Soil Management Fertilizer Responses

Draft Outline

Background

Fertilizer application rates have been derived to achieve maximum production. With falling prices and delays in payment for crops delivered. reduction in costs of production has now become a necessity. Serious questions are being asked about optimum levels of input application and many farmers are requesting soil analysis.

Compound fertilizers are mainly used as these have low N&P contents. Both urea and calcium ammonium nitrate are used as supplements. Heavy dosage rates are recommended for winter-sown crops which must result in high losses of nutrients.

It is well recognized that with different rates of nitrogen application the grain yield response is steep at lower increments (e.g. 0-30 or 30-60 kg/N/ha) and flattens out at higher (e.g. 100-120 and 120-150 kg/N/ha) rates. It is also common that 70-80 percent of the highest grain yield attained is obtained with 50 percent less of the "recommended" rate in a given situation. One must seriously question the current high rates of fertilizer being recommended. More attention is paid to the previous promotion of fertilizers *per se*, rather than to their efficient use. With the escalation in the cost of fertilizers, it has become imperative that fertilizers be used in a manner that gives the optimum return for investment.

A major problem exists for the farmer to gain advice on his fertilizer regimes and this is widely recognized. The development of response curves through on-farm testing must be top priority in any applied research programme. Useful data on individual soil analyses are available which, if consolidated on an areas basis, could provide the basis for detailed soil mapping which in turn could provide the basis for implementation of an on-farm testing trials.

Soil acidity problems are widely reported by research workers. Research staff recommend liming soils below pH 4.5, but financial returns are not known. Alternative land use patterns on acid soils have not yet been considered.

Objectives

- To reduce costs of production and increase gross margins;
- to optimize production per unit of nutrient;
- to control loss of chemicals through leaching and indirectly protect the environment;
- to evaluate and further test the effects of lime application on acid soils;
- to test alternative crops/pastures on acid soils; and

- to provide packages for extension delivery.

Approach

Under the project, scientists would first review existing data on fertilizer responses. The considerable amount of soil testing results should be collated on the basis of soil type and could provide the basis of preliminary fertilizer recommendations which could be expected to improve crop gross margins. Similarly, the responses to liming under certain conditions could provide for an early recommendation.

These preliminary recommendations must be fine-tuned through the derivation of response curves, yield against cost over a range of soil and climatic conditions. Trials could be operated by the farmers themselves.

The programme would:

- derive initial packages on the basis of previous results for field testing;
- monitor plant growth indices;
- record yields on various treatments applied;
- derive response curves; and
- provide soil type based packages for extension delivery.

Benefits

The programme would be carried out over all agro-economic zones and on the main crops represented. Benefits would be spread over the national farming population and would include:

- lower costs of production;
- optimizing returns/unit of nutrient; and
- positive environmental effects.

1.2 Tillage Systems

Draft Outline

Background

Traditional and universally used tillage systems consist of mouldboard ploughing (20-30 cm), followed by disc harrowing. Over the years this has resulted in the creation of soil pans, often impermeable, and deterioration of surface structures by disking during dry conditions, resulting in soil capping. While rainfall appears in most cases to be sufficient for crop growth, the storage of moisture is limited both by a restricted absorptive profile or run-off due to soil capping. The costs of current land preparation are high.

About 60 percent of soils now have structural limitations. This is due both to basic soil characters, i.e. high permeability, light texture and, more commonly, to structural problems created through inappropriate tillage techniques.

Tillage research under similar conditions has shown that the substitution of mouldboard ploughing and disc harrowing by chisel ploughing, spring tine cultivating and scarifying has resulted in lower costs of cultivation and yield increases. Suitable equipment is not available within RS or the Federation.

Objectives

- To reduce tillage costs;
- to break soil pans and improve infiltration and water-holding capacity;
- to control weed growth;
- to reduce soil capping through use of spring tine cultivators;
- to provide for optimum seedbed structure;
- to improve soil structure over the medium term;
- to increase yield at low cost.

Approach

As equipment is currently not available locally, it would have to be introduced for a trial and demonstration programme.[1] Advice would be required for the procurement of suitable ancillary cultivation equipment and its sourcing. A technical assistance would be required.

Field testing on different soils would compare the efficiency of operation and costs with the traditional system and provide for farmer demonstration.

In parallel with practical field testing. graduate research programmes could monitor soils/moisture relationship.

[1] Australian manufactured equipment has been shown to be suitable under similar conditions.

Should results prove positive the options of either local fabrication or production under licence could be explored.

Benefits

Benefits would be widespread over the continental agro-economic zones, and some 60 percent of farmers could ultimately benefit. Profitability of crop production could be expected both from reduction in cultivation costs and increment in yield - particularly in drier years. The reliability of cropping would be significantly increased.

Benefits to the environment would accrue from control of run-off and soil erosion.

1.3 Farming Systems Research
Draft Outline

Background

Recent policies encourage the development of private farms and the liberalization of state farms and processing units, but success has been hampered by a lack of experience in running small and medium-sized enterprises, and in commercial management and production systems. Without this expertise the potential for developing an efficient and competitive agricultural sector will not be realized.

Current cropping systems are inherited from social farming systems, and consequently there is considerable scope for improvement in both crop and livestock cultural practices and modest investment in technically profitable packages.

The concept of optimization of profit and providing for farming systems which exploit the comparative advantages of resources and the market is only now beginning to be recognized.

The diversity between zones, but with strong intra-zonal homogeneity, requires a zonal level approach. Research programmes should be based on local constraint analysis. farming systems and farmer participation, together with the need to monitor farm systems development closely.

Objective

The major objective is to devise a farm production mix of enterprises which produces maximum profit at low levels of input and is found acceptable by farmers. This can be achieved through the promotion of crops and cropping systems which have known comparative advantage in profitability. market outlets and overall suitability for the varied agro-economic conditions.

Approach

- To analyse current farming systems, costs of production, gross margins, etc. on representative farms at zonal level and to identify the major constraints to increased profitability;
- To introduce crop/livestock packages which could increase profit; these are likely to be:

  - varietal improvements;
  - tillage and cultural practices;
  - reduction in seed rates;
  - reduction in fertilizer application rates;
  - promotion of alternative crops having comparative advantage. e.g. oilseeds. early potatoes. etc.
  - reduction in costs of production for crops and livestock;
  - intensification of cropping patterns;

- investigations into the costs and returns to irrigation where potential exists.

Benefits

The benefits could cover a wide range of farming systems in all zones and rely on a bottom-up approach to research programming and farmer participation. The benefits would accrue through increased profitability.

1.4 Study on Industrial Crops

Draft Outline

Background

The reconstruction of the RS industrial sector will be led largely through the rehabilitation and future growth potential of the livestock industry. This is unlikely to be achieved on the basis of imported proteins, i.e. oil crops. Furthermore, oil crops must be considered to be viable alternatives for crop diversification, based on land capability and climate. There are also deficits in edible cooking oils.

Oil crop processing was traditionally in the social sector and subject to the usual inefficiencies resulting in the inability to pay farmers for product delivered.

Two options should be considered for the rehabilitation of the processing industry:

(a) Privatization and rehabilitation of existing facilities. This approach is unlikely to attract donor support due to the high costs involved and the small capacity of the producers.

(b) The construction of small mills using a simple expeller process based on farmer associations of growers and possibly attached to the facilities already being developed by the private feed millers. This has the advantage of low cost and high oil quality animal feed cake. A central oil purification facility would be necessary to refine oil for edible use.

Approach

It is proposed that the ministry carry out an industrial crop policy study which would have the following objectives:

- to assess the impact of current government policy (price and trade) on oilseed production;
- to elevate current and new production and processing technology and model its impact on crop gross margins, farming systems and industrial processing profitability;
- to identify policy changes which have the potential of increasing production efficiency in both the private and ex-social sectors;

to recommend transitional measures to support local producers and encourage diversification to other crops.

APPENDIX 2

GROSS MARGIN MAIN CROPS

Gross Margin - Wheat (ha)

		DM
A.	Income - 4 tonnes x DM0.27/kg	1,080
B.	Production Costs (machinery services)	
	1. Ploughing	120
	2. Harrowing I	50
	3. Harrowing II	40
	4. Harrowing (teeth harrow)	50
	5. Distribution of Mineral Fertilizers	40
	6. Sowing	50
	7. Weed Protection	30
	8. Cultivation with Top-dressing	30
	9. Harvesting	130
	Subtotal	**540**
C.	Input Costs	
	1. Mineral Fertilizers NPK 15/15/15 (300 kg/ha x DM0.40/kg)	120
	2. Mineral Fertilizers CAN 27% (200 kg/ha x DM0.25/kg)	50
	3. Seed (270 kg/ha x DM0.70/kg)	75
	4. Herbicide	
	Primextra (6 1itre/ha x DM15)	189
	Tarot (25 g/ha x DM2)	90
	Monosan Combi (4 litre/ha)	40
	TOTAL	**399**
D.	Gross Margin (DM1,080 - DM939)	141/ha

Gross Margin - Maize (ha)

		DM
A.	Income - 5.5 tonnes x DM0.20/kg	1,210
B.	Production Costs (mechanization services)	
	1. Ploughing	120
	2. Harrowing I	50
	3. Harrowing II	40
	4. Harrowing (teeth harrow)	30
	5. Distribution of Mineral Fertilizers	40
	6. Sowing	50
	7. Weed Protection	30
	8. Cultivation with Top-dressing	50
	9. Harvesting (mechanization)	180
	Subtotal	**590**
C.	Input Costs	
	1. Mineral Fertilizers NPK 15/15/15 (500 kg/ha x DM0.40/kg)	200
	2. Mineral Fertilizers CAN 27% (200 kg/ha x DM0.25/kg)	75
	3. Seed (270 kg/ha x DM2.0/kg)	36
	4. Herbicide	
	Primextra (6 1itre/ha x DM15)	90
	Tarot (25 g/ha x DM2)	50
	TOTAL	**451**
D.	Gross Margin (DM1,210 – DM1,041)	169/ha

Gross Margin - Soya Bean (ha)

		DM
A.	Income - 2 tonnes x DM0.6/kg	1,200.0
B.	Production Costs (mechanization services)	
	1. Ploughing	120.0
	2. Harrowing I	50.0
	3. Harrowing II	40.0
	4. Harrowing (teeth harrow)	30.0
	5. Distribution of Mineral Fertilizers	40.0
	6. Sowing	60.0
	7. Weed Protection	30.0
	8. Cultivation (2x)	80.0
	9. Harvesting (12% from yields)	170.0
	Subtotal	**627.0**
C.	Input Costs	
	1. Mineral Fertilizers NPK 15/15/10 (300 kg/ha x DM0.40/kg)	120.0
	2. Commercial Seed (100 kg x DM1.20/kg)	120.0
	3. Herbicide	
	Lasso EC (4.5 litre/ha x DM11)	49.5
	Efalon Liquid (1.8 litre/ha x DM 23)	41.4
	Focus Ultra (1.01 litre/ha x DM50)	50.0
	TOTAL	**380.9**
D.	Gross Margin (DM1,200 - DM1,008)	192/ha

Source: Crop, Fruit and Vegetable Production Working Group

Region Hilly

Name and Family name Seval Suljkanovic **Village** Mionica

Municipality Gradacac

CALCULATION
for Tomato

Parameters	Unit of measure	Amount	Price per unit DM	Total
A/ INCOME				
Yield per ha Sold	kg	30,000	0.20	6,000.00
Sub-total				**6,000.00**
B/ VARIABLE COSTS				
Seed				
– purchased	kg	1.50	300.00	450.00
– produced		1,500.00	0.40	600.00
Fertilizer				
– NPK	kg	500.00	0.50	250.00
– KAN		200.00	0.35	70.00
– Urea				
– Other		20.00	4.00	80.00
Chemicals				
– Pesticide				
– Herbicide	l	2.00	70.00	140.00
– Fungicide	kg	6.00	40.00	240.00
Land cultivation				
– ploughing		1.00	300.00	300.00
– land preparation		3.00	60.00	180.00
– protection		1.00	120.00	120.00
Harvest				
Hiring of workers	man/day	30	25.00	750.00
Work of family	man/day	10.00	25.00	250.00
Other costs – transport				1,200.00
Interest on operational cost[1]				92.60
Sub-total				4,722.60
Amortization				
TOTAL				**4,722.60**
Gross margin/ha				**1,277.40**

[1] Cost of purchased seed, fertilizer, chemicals, machinery work, hiring work) X (number of months from the purchase to the harvest) X interest rate = 4,630.00 X 3 X 0.08 = 92.60

Region Hilly

Name and Family name Husljic Esed **Village** Ledenice

Municipality Gradacac

CALCULATION
for Potato

Parameters	Unit of measure	Amount	Price per unit DM	Total
A/ INCOME				
Yield per ha Sold	kg	16,000	0.40	6,400.00
Sub-total				**6,400.00**
B/ VARIABLE COSTS				
Seed				
– purchased	kg	2,500	0.70	1,750.00
– produced		540	0.30	160.00
Fertilizer				
– NPK	kg	600	0.50	300.00
– KAN		300	0.35	105.00
– Urea				
– Other				
Chemicals				
– Pesticide	kg	0.5	300.00	150.00
– Herbicide	kg	1	110.00	110.00
– Fugicide	kg	2	25.00	50.00
Land cultivation				
– machinery		1	400,00	400.00
– animals				
Harvest		2	60.00	120.00
Hiring of workers	man/day	10	20.00	200.00
Work of family	man/day	5	20.00	100.00
Other costs – sold				640.00
Interest on operational cost[1]				136.16
Sub-total				4,221.16
Amortization				
TOTAL				**4,221.16**
Gross margin/ha				**2,178.84**

- selling on the green market

[1] Cost of purchased seed, fertilizer, chemicals, machinery work, hiring work) X (number of months from the purchase to the harvest) X interest rate = 4,087.00 X 5 X 0.08 = 136.23

Region Hilly

Name and Family name Rasim Djedovic **Village** Jelovice

Municipality Gradacac

CALCULATION
for Maize production

Parameters	Unit of measure	Amount	Price per unit DM	Total
A/ INCOME				
Yield per ha Sold	kg	8,000	0.30	2,400.00
Sub-total				**2,400.00**
B/ VARIABLE COSTS				
Seed				
– purchased	kg	30	2.80	84.00
– produced				
Fertilizer				
– NPK	kg	600	0.50	300.00
– KAN				
– Urea	kg	200	0.38	76.00
– Other				
Chemicals				
– Pesticide				
– Herbicide	l.	4	25.00	100.00
– Fugicide				
Land cultivation				
– ploughing	day	1	150.00	
– land preparation		1	150.00	
– protection of		1	60.00	
culture		1	60.00	
– seeding		1	60.00	480.00
– cultivation				
Harvest	man/day	8	30.00	240.00
Hiring of workers	man/day	10	30.00	300.00
Work of family	bag	160	0.30	48.00
Other costs – Transport		7	20.00	140.00
Interest on operational cost[1]				70.72
Sub-total				1,838.72
Amortization				
TOTAL				**1,838.72**
Gross margin/ha				**561.28**

[1] Cost of purchased seed, fertilizer, chemicals, machinery work, hiring work) X (number of months from the purchase to the harvest) X interest rate

Region Hilly

Name and Family name Omer Kavazovic **Village** Jelovice

Municipality Gradacac

CALCULATION
for Wheat production

Parameters	Unit of measure	Amount	Price per unit DM	Total
A/ INCOME				
Yield per ha	kg	4,000	0.35	1,400.00
Other	kg	2,000	0.10	200.00
Sub-total				**1,600.00**
B/ VARIABLE COSTS				
Seed				
– purchased	kg	300	1.00	300.00
– produced				
Fertilizer				
– NPK	kg	500	0.50	250.00
– KAN		500	0.38	76.00
– Urea				
– Other				
Chemicals				
– Pesticide	kg	2	25.00	50.00
– Herbicide		4	25.00	100.00
– Fungicide				
Land cultivation				
– ploughing	ha	1	250.00	
– land preparation		1	60.00	
– protection of culture		2	60.00	430.00
Harvest	ha	1	160.00	160.00
Hiring of workers	man/day	2	25.00	50.00
Work of family	man/day	3	25.00	75.00
Other costs	man/day	2	25.00	50.00
Interest on operational cost[1]	month	6	10.27	61.62
Sub-total				1,602.62
Amortization				
TOTAL				**1,602.62**
Gross margin/ha				**- 2.62**

[1] Cost of purchased seed, fertilizer, chemicals, machinery work, hiring work) X (number of months from the purchase to the harvest) X interest rate

Region Hilly

Name and Family name Vahid Besirevic **Village** Bagdala

Municipality Gradacac

CALCULATION
for Peach

Parameters	Unit of measure	Amount	Price per unit DM	Total
A/ INCOME				
Yield per ha Sold	kg	25.000	0.70	17,500.00
Sub-total				**17,500.00**
B/ VARIABLE COSTS				
Seed				
– purchased	Box 4/1	6,250	0.40	2,500.00
– produced				
Fertilizer				
– NPK	kg	1,200	0.30	600.00
– KAN		400	0.35	140.00
– Urea		20	4.00	80.00
– Other				
Chemicals				
– Pesticide	kg	16	30.00	480.00
– Herbicide				
– Fungicide		6	30.00	240.00
Land cultivation				
– cultivation	ha	4	120.00	
– protection		5	60.00	780.00
Harvest	man/day	30	30.00	900.00
Hiring of workers		25.00	30.00	750.00
Work of family	man/day	10	30.00	300.00
Other costs	man/day	11	70.00	770.00
Interest on operational cost[1]	month	4.5	50.26	226.17
Sub-total				7,766.17
Amortization	yearly	13%	20,000	2,600.00
TOTAL				**10,366.17**
Gross margin/ha				**7,133.83**

[1] Cost of purchased seed, fertilizer, chemicals, machinery work, hiring work) X (number of months from the purchase to the harvest) X interest rate

Region Hilly

Name and Family name Halil Bajramovic **Village** Lukavac

Municipality Gradacac

CALCULATION
for Apple

Parameters	Unit of measure	Amount	Price per unit DM	Total
A/ INCOME				
Yield per ha	kg I class	21,000	0.50	10,500.00
	kg II class	9,000	0.15	1,350.00
Sub-total				**11.850.00**
B/ VARIABLE COSTS				
Seed				
– purchased	Box 4/1	1,400	0.70	980.00
	bags 25/1	360	0.40	144.00
Fertilizer				
– NPK	kg	1,000	0.50	500.00
– KAN		400	0.38	158.00
– Urea				
– Other				
Chemicals				
– Pesticide	l	16	35.00	560.00
– Herbicide				
– Fungicide		8	35.00	280.00
Land cultivation				
– cultivation		4	120.00	
– protection		6	60.00	840.00
Harvest	man/day	7	70.00	490.00
Hiring of workers	man/day	20	30.00	600.00
Work of family	man/day	10	30.00	300.00
Other costs				1,200.00
Interest on operational cost[1]	month	4.5	40.30	181.37
Sub-total				6,227.37
Amortization	yearly	6%	27,576.30	1,654.58
TOTAL				**7,881.95**
Gross margin/ha				**3,968.05**

[1] Cost of purchased seed, fertilizer, chemicals, machinery work, hiring work) X (number of months from the purchase to the harvest) X interest rate

Region Hilly

Name and Family name Vahid Besirevic **Village** Bukva

Municipality Gradacac

CALCULATION
for Pear

Parameters	Unit of measure	Amount	Price per unit DM	Total
A/ INCOME				
Yield per ha	kg I class	17,500	0.50	8,750.00
Sold	kg II class	7,500	0.20	1,500.00
Sub-total				**10,250.00**
B/ VARIABLE COSTS				
Seed				
– purchased	Box 5/1	3,500	0.40	1,400.00
	Box 13/1	500	0.70	350.00
Fertilizer				
– NPK	kg	1,000	0.50	500.00
– KAN				
– Urea		200	0.50	100.00
– Other				
Chemicals				
– Pesticide	kg	15	35.00	525.00
– Herbicide				
– Fugicide		8	30.00	240.00
Land cultivation				
– cultivation		3	120.00	
– protection		5	60.00	660.00
Harvest	man/day	7	70.00	490.00
Hiring of workers	man/day	25	30.00	750.00
Work of family	man/day	10	30.00	300.00
Other costs				1,000.00
Interest on operational cost[1]	month	4.5	42,1	189.45
Sub-total				**6,504.45**
Amortization	yearly	5%	24,174.20	1,208.71
TOTAL				**7,713.16**
Gross margin/ha				**2,536.84**

[1] Cost of purchased seed, fertilizer, chemicals, machinery work, hiring work) X (number of months from the purchase to the harvest) X interest rate

Region Hilly

Name and Family name Zaim Djedovic **Village** Lukavice

Municipality Gradacac

CALCULATION
for Plum

Parameters	Unit of measure	Amount	Price per unit DM	Total
A/ INCOME				
Yield per ha	kg	20,000	0.40	8,000.00
Sold				
Sub-total				**8,000.00**
B/ VARIABLE COSTS				
Seed				
– purchased	Box	1,000	0.70	700.00
– produced				
Fertilizer				
– NPK	kg	1,000	0.45	450.00
– KAN		300	0.35	105.00
– Urea				
– Other				
Chemicals				
– Pesticide	l/kg	10	35.00	350.00
– Herbicide				
– Fungicide		4	30.00	120.00
Land cultivation				
– cultivation		2	60.00	
– tree cutting		6	70.00	540.00
Harvest	man/day	20	30.00	600.00
Hiring of workers	bag	20,000	0.03	600.00
Work of family	man/day	10	30.00	300.00
Other costs				800.00
Interest on operational cost[1]	month	4.5	30.44	137.00
Sub-total				4,702.00
Amortization	yearly	6%	17,695	1,061.70
TOTAL				**5,763.70**
Gross margin/ha				**2,236.30**

[1] Cost of purchased seed, fertilizer, chemicals, machinery work, hiring work) X (number of months from the purchase to the harvest) X interest rate

Region Hilly

Name and Family name Esad Huskic **Village Huskici**

Municipality Gradacac

CALCULATION
for Strawberry

Parameters	Unit of measure	Amount	Price per unit DM	Total
A/ INCOME				
Yield per ha	kg	10,000	0.80	8,000.00
Sold				
Sub-total				**8,000.00**
B/ VARIABLE COSTS				
Seed				
– purchased	Box	1,430	0.40	572.00
– produced				
Fertilizer				
– NPK	kg	600	0.50	300.00
– KAN		300	0.38	114.00
– Urea				
– Other				
Chemicals				
– Pesticide	l/kg	4	35.00	140.00
– Herbicide		3	40.00	120.00
– Fungicide		4	35.00	140.00
Land cultivation				
– machinery	5	5	72.00	360.00
– animals				
Harvest				
Hiring of workers	man/day	20	25.00	500.00
Work of family	man/day	20	25.00	500.00
Other costs				400.00
Interest on operational cost[1]	month	3	21.00	63.00
Sub-total				3,209.00
Amortization	yearly	21%	15,409	3,235.89
TOTAL				**6,444.89**
Gross margin/ha				**1,555.11**

[1] Cost of purchased seed, fertilizer, chemicals, machinery work, hiring work) X (number of months from the purchase to the harvest) X interest rate

Region Flat

Name and Family name Marian Jokic **Village Ostra luka**

Municipality Orasje

CALCULATION
for Tomato

Parameters	Unit of measure	Amount	Price per unit DM	Total
A/ INCOME				
Yield per ha Sold	kg	70,000	0.60	42,000.00
Sub-total				**42,000.00**
B/ VARIABLE COSTS				
Seed				
– purchased	kg	0.15	25,000	3,750.00
– produced				
Fertilizer				
– NPK	kg	700	0.40	280.00
– KAN	kg	400	0.30	120.00
– Urea	kg	15,000	0.05	750.00
– Other				1,000.00
Chemicals				
– Pesticide	kg	10	15.00	150.00
– Herbicide		5	20.00	100.00
– Fungicide		4	30.00	120.00
Land cultivation				
– machinery	ha	1	980.00	980.00
– animals				
Harvest	hours	350	3,50	1,225.00
Hiring of workers	hours	300	3.50	1,050.00
Work of family	hours	300	3.50	1,050.00
Other costs				24,000.00
Interest on operational cost[1]		3	230.50	691.50
Sub-total				35,266.50
Amortization				
TOTAL				**35,266.50**
Gross margin/ha				**6,733.50**

[1] Cost of purchased seed, fertilizer, chemicals, machinery work, hiring work) X (number of months from the purchase to the harvest) X interest rate

Region Flat

Name and Family name Djuro Jovic **Village** Kopanice

Municipality Orasje

CALCULATION
for Paprika

Parameters	Unit of measure	Amount	Price per unit DM	Total
A/ INCOME				
Yield per ha	kg	25,000	0.70	17,500.00
Sold				
Sub-total				**17,500.00**
B/ VARIABLE COSTS				
Seed				
– purchased	kg	0.5	1,000.00	500.00
– produced				
Fertilizer				
– NPK	kg	700	0.40	280.00
– KAN		400	0.30	120.00
– Urea		10,000	0.05	500.00
– Other	l	10	20.00	200.00
Chemicals				
– Pesticide	l	10	15	150.00
– Herbicide		5	20	100.00
– Fungicide		5	30	150.00
Land cultivation				
– machinery		1	980.00	980.00
– animals				
Harvest	hours	300	3.50	1,050.00
Hiring of workers	hours	250	3.50	875.00
Work of family	hours	100	3.50	350.00
Other costs				4,375.00
Interest on operational cost[1]		4	64.20	256.80
Sub-total				**9,886.80**
Amortization				
TOTAL				**9,886.80**
Gross margin/ha				**7,613.20**

[1] Cost of purchased seed, fertilizer, chemicals, machinery work, hiring work) X (number of months from the purchase to the harvest) X interest rate

Region Flat

Name and Family name Darko Mrkovic **Village** Bok

Municipality Orasje

CALCULATION
for Wheat

Parameters	Unit of measure	Amount	Price per unit DM	Total
A/ INCOME				
Yield per ha	kg	5,000	0.35	1,750.00
Sold				
Sub-total				**1,750.00**
B/ VARIABLE COSTS				
Seed				
– purchased	kg	250	0.75	187.50
– produced				
Fertilizer				
– NPK	kg	400	0.44	176.00
– KAN		200	0.30	60.00
– Urea		150	0.44	66.00
– Other				
Chemicals				
– Pesticide				
– Herbicide	l	4	16.00	64.00
– Fungicide		2	89.00	178.00
Land cultivation				
– machinery		1	485.00	485.00
– animals				
Harvest	ha	1	200.00	200.00
Hiring of workers	hours	20	3.00	60.00
Work of family				
Other costs				
Interest on operational cost[1]		6	9.84	59.06
Sub-total				**1,535.56**
Amortization				
TOTAL				**1,535.56**
Gross margin/ha				**214.44**

[1] Cost of purchased seed, fertilizer, chemicals, machinery work, hiring work) X (number of months from the purchase to the harvest) X interest rate

Region Flat

Name and Family name Marko Durkovic **Village** Donja Mahala

Municipality Orasje

CALCULATION
for Maize

Parameters	Unit of measure	Amount	Price per unit DM	Total
A/ INCOME				
Yield per ha Sold	kg	8,500	0.23	1,955.00
Sub-total				**1,955.00**
B/ VARIABLE COSTS				
Seed				
– purchased	kg	20	3.00	60.00
– produced				
Fertilizer				
– NPK	kg.	250	0.44	110.00
– KAN		400	0.30	120.00
– Urea		150	0.44	66.00
– Other				
Chemicals				
– Pesticide				
– Herbicide	2	8	20.00	160.00
– Fungicide				
Land cultivation				
– machinery	ha	1	672.00	672.00
– animals				
Harvest		1	200.00	200.00
Hiring of workers	hours	60	3.00	180.00
Work of family	hours	50	3.00	150.00
Other costs				
Interest on operational cost[1]		6	11.45	68.70
Sub-total				**1,786.70**
Amortization				
TOTAL				**1,786.70**
Gross margin/ha				**168.30**

[1] Cost of purchased seed, fertilizer, chemicals, machinery work, hiring work) X (number of months from the purchase to the harvest) X interest rate

Agricultural Enterprise "Spreca"
Donje Vukovije - Kalesija

CALCULATION
OF WHEAT PRODUCTION ON 283 HA
(Yield 3 t/ha)

Parameters	Unit of measure	Amount	Price (DM)	Total
INCOME				
- wheat grain	kg	849,000	0.40	339,600.00
- wheat straw	kg	424,000	0.10	42,400.00
Total income				**382,000.00**
COSTS				
Seed	kg	84,900	0.80	67,920,00
Fertilizer				
-NPK	kg	144,330	0.40	57,732.00
-KAN		61,100	0.30	18,330.00
Chemicals				
-herbicide	l	1,132	14.00	15,848.00
Labour				
-Brutto salaries for permanent workers				71,000.00
-Brutto salaries for part-time workers				9,600.00
-Lunches				8,200.00
Fuel	l	41,700	1.00	41,700.00
Mechanical oil	l	1,140	5.00	5,700.00
Mechanical fat	kg	145	5.00	725.00
Spare parts				15,000
Office supplies				900.00
Energy				4,500.00
Transport services				5,000.00
Repairing services				2,200.00
Advertising				300.00
Bank services				300.00
Interest				7,000.00
Money exchange				350.00
Non-production services				2,100.00
Representation				400.00
Tax fee				3,000.00
Drying				14,000.00
Amortization				24,000.00
Other				4,000.00
TOTAL				**380,005.00**
Gross margin				**1,995.00**

Agricultural Enterprise "Spreca"
Donje Vukovije - Kalesija

CALCULATION
OF OATS PRODUCTION ON 265 HA
(Yield 2.4 t/ha)

Parameters	Unit of measure	Amount	Price (DM)	Total
INCOME				
- oats grain	kg	636,000	0.40	254,400.00
- oats straw	kg	397,000	0.10	39,700.00
Total income				**294,100.00**
COSTS				
Seed	kg	66,250	1.00	66,250.00
Fertilizer				
-NPK	kg	79,500	0.40	31,800.00
-KAN		53,000	0.30	15,900.00
Chemicals				
-herbicide				
Labour				
-Brutto salaries for permanent workers				55,000.00
-Brutto salaries for part-time workers				8,000.00
-Lunches				6,000.00
Fuel	l	37,100	1.00	37,100.00
Mechanical oil	l	795	5.00	3,975.00
Mechanical fat	kg	133	5.00	665.00
Spare parts				4,500.00
Office supplies				800.00
Energy				4,000.00
Transport services				4,000.00
Repairing services				2,000.00
Advertising				200.00
Bank services				250.00
Interest				6,200.00
Money exchange				280.00
Non-production services				1,900.00
Representation				300.00
Tax fee				2,500.00
Drying				11,000.00
Amortization				23,000.00
Other				3,500.00
TOTAL				**289,120.00**
Gross margin				**4,980.00**

Agricultural Enterprise "Spreca"
Donje Vukovije - Kalesija

CALCULATION
OF RYE PRODUCTION ON 150 HA
(Yield 3 t/ha)

Parameters	Unit of measure	Amount	Price (DM)	Total
INCOME				
-rye grain	kg	450,000	0.35	157,500.00
-rye straw	kg	600,000	0.10	60,000.00
Total income				**217,500.00**
COSTS				
Seed		24,950	0.60	14,970.00
Fertilizer				
-NPK	kg	59,250	0.40	23,700.00
-KAN		21,650	0.30	6,495.00
Chemicals				
-herbicide				
Labour				
-Brutto salaries for permanent workers				50,780.00
-Brutto salaries for part-time workers				10,500.00
-Lunches				4,500.00
Fuel	l	22,500	1.00	22,500.00
Mechanical oil		750	5.00	3,750.00
Mechanical fat	kg	80	5.00	400.00
Spare parts				4.500.00
Office supplies				700.00
Energy				4,000.00
Transport services				3,500.00
Repairing services				2,000.00
Advertising				150.00
Bank services				250.00
Interest				6,200.00
Money exchange				280.00
Non-production services				1,900.00
Representation				300.00
Tax fee				1,500.00
Drying				13,000.00
Amortization				22,000.00
Other				3,000.00
TOTAL				**200,875.00**
Gross margin				**16,625.00**

Agricultural Enterprise "Spreca"
Donje Vukovije - Kalesija

CALCULATION
OF MAIZE IN GRAIN PRODUCTION ON 400 HA
(Yield 3.2 t/ha)

Parameters	Unit of measure	Amount	Price (DM)	Total
INCOME				
-mercantile maize in grain	kg	1,280.000	0.33	422,400.00
Total income				**422,400.00**
COSTS				
Seed	kg	8,000	2.00	16,000.00
Fertilizer				
-NPK	kg	200,000	0.40	80,000.00
-KAN		112,000	0.30	33,600.00
-Urea		40,000	0.35	14,000.00
Chemicals				
-herbicide	l	2,400	12.00	28,800.00
Labour				
-Brutto salaries for permanent workers				80,000.00
-Brutto salaries for part-time workers				6,000.00
-Lunches				8,000.00
Fuel	l	56,000	1.00	56,000.00
Mechanical oil	l	2,100	5.00	10,500.00
Mechanical fat	kg	200	5.00	1,000.00
Spare parts				10,700.00
Office supplies				1,100.00
Energy				6,000.00
Transport services				6,000.00
Repairing services				2,700.00
Advertising				270.00
Bank services				600.00
Interest				8,000.00
Money exchange				650.00
Non-production services				5,600.00
Representation				400.00
Tax fee				5,300.00
Drying				30,000.00
Amortization				35,000.00
Other				5,000.00
TOTAL				**451,220.00**
Gross margin				**- 28,820.00**

Agricultural Enterprise "Spreca"
Donje Vukovije - Kalesija

CALCULATION
OF WHEAT PRODUCTION ON 1 HA

Parameters	Unit of measure	Amount	Price (DM)	Total
INCOME				
-mercantile wheat	kg	3,000.00	0.40	1,200.00
-wheat hay	kg	1,498.20	0.10	149.82
Total income				**1,349.82**
COSTS				
Seed	kg	300	0.80	240.00
Fertilizer				
-NPK	kg	510	0.40	204.00
-KAN		215.90	0.30	64.80
Chemicals				
-herbicide	l	4	14.00	56.00
Labour				
-Brutto salaries for permanent workers				251.55
-Brutto salaries for part-time workers				33.92
-Lunches				28.97
Fuel	l	147.35	1.00	147.35
Mechanical oil	l	4.03	5.00	20.15
Mechanical fat	kg	0.51	5.00	2.55
Spare parts				53.00
Office supplies				3.20
Energy				15.90
Transport services				17.70
Repairing services				7.80
Advertising				1.06
Bank services				1.06
Interest				24.73
Money exchange				1.23
Non-production services				7.42
Representation				1.41
Tax fee				10.60
Drying				49.47
Amortization				84.80
Other				14.10
TOTAL				**1,342.77**
Gross margin/HA				**7.05**

Agricultural Enterprise "Spreca"
Donje Vukovije - Kalesija

CALCULATION
OF OATS PRODUCTION ON 1 HA
(Yield 2.4 t/ha)

Parameters	Unit of measure	Amount	Price (DM)	Total
INCOME				
-mercantile oats	kg	2,400	0.40	960.00
-oats hay	kg	1,498	0.10	149.80
Total income				**1,109.80**
COSTS				
Seed	kg	250	1.00	250.00
Fertilizer				
-NPK	kg	300	0.40	120.00
-KAN		200	0.30	60.00
Chemicals				
-herbicide				
Labour				
-Brutto salaries for permanent workers				207.55
-Brutto salaries for part-time workers				30.19
-Lunches				22.64
Fuel	l	140	1.00	140.00
Mechanical oil	l	3	5.00	15.00
Mechanical fat	kg	0.5	5.00	2.50
Spare parts				16.98
Office supplies				3.02
Energy				15.10
Transport services				15.10
Repairing services				7.55
Advertising				0.75
Bank services				0.94
Interest				23.40
Money exchange				1.06
Non-production services				7.17
Representation				1.13
Tax fee				9.43
Drying				41.51
Amortization				86.79
Other				13.20
TOTAL				**1,091.01**
Gross margin/ha				**18.79**

Agricultural Enterprise "Spreca"
Donje Vukovije - Kalesija

CALCULATION
OF RYE PRODUCTION ON 1 HA

Parameters	Unit of measure	Amount	Price (DM)	Total
INCOME				
-mercantile rye	kg	3,000	0.35	1,050.00
-rye hay	kg	4,000	0.10	400.00
Total income				**1,450.00**
COSTS				
Seed		166.3	0.60	99.80
Fertilizer				
-NPK	kg	395.00	0.40	158.00
-KAN		144.00	0.30	43.30
Chemicals				
-herbicide				
Labour				
-Brutto salaries for permanent workers				
-Brutto salaries for				338.53
part-time workers				70.00
-Lunches				30.00
Fuel	l	150.00	1.00	150.00
Mechanical oil		5	5.00	25.00
Mechanical fat	kg	0.54	5.00	2.66
Spare parts				30.00
Office supplies				4.67
Energy				26.67
Transport services				23.34
Repairing services				13.33
Advertising				1.00
Bank services				1.67
Interest				41.33
Money exchange				1.86
Non-production services				12.67
Representation				2.00
Tax fee				10.00
Drying				86.67
Amortization				146.67
Other				20.00
TOTAL				**1,339.17**
Gross margin/ha				**110.83**

Agricultural Enterprise "Spreca"
Donje Vukovije - Kalesija

CALCULATION
OF MAIZE IN GRAIN PRODUCTION ON 1 HA
(Yield 3.2 t/ha)

Parameters	Unit of measure	Amount	Price (DM)	Total
INCOME				
-mercantile maize in grain	kg	3,200	0.33	1,056.00
Total income				**1,056.00**
COSTS				
Seed	kg	20	2.00	40.00
Fertilizer				
-NPK	kg	50	0.40	200.00
-KAN		280	0.30	84.00
-Urea		100	0.35	35.00
Chemicals				
-herbicide	l	6	12.00	72.00
Labour				
-Brutto salaries for permanent workers				200.00
-Brutto salaries for part-time workers				15.00
-Lunches				20.00
Fuel	l	140	1.00	140.00
Mechanical oil	l	5.25	5.00	26.25
Mechanical fat	kg	0.50	5.00	2.50
Spare parts				26.75
Office supplies				2.75
Energy				15.00
Transport services				15.00
Repairing services				6.75
Advertising				0.67
Bank services				1.50
Interest				20.00
Money exchange				1.63
Non-production services				14.00
Representation				1.00
Tax fee				13.25
Drying				75.00
Amortization				87.50
Other				12.50
TOTAL				**1,128.05**
Gross margin/ha				**72.05**