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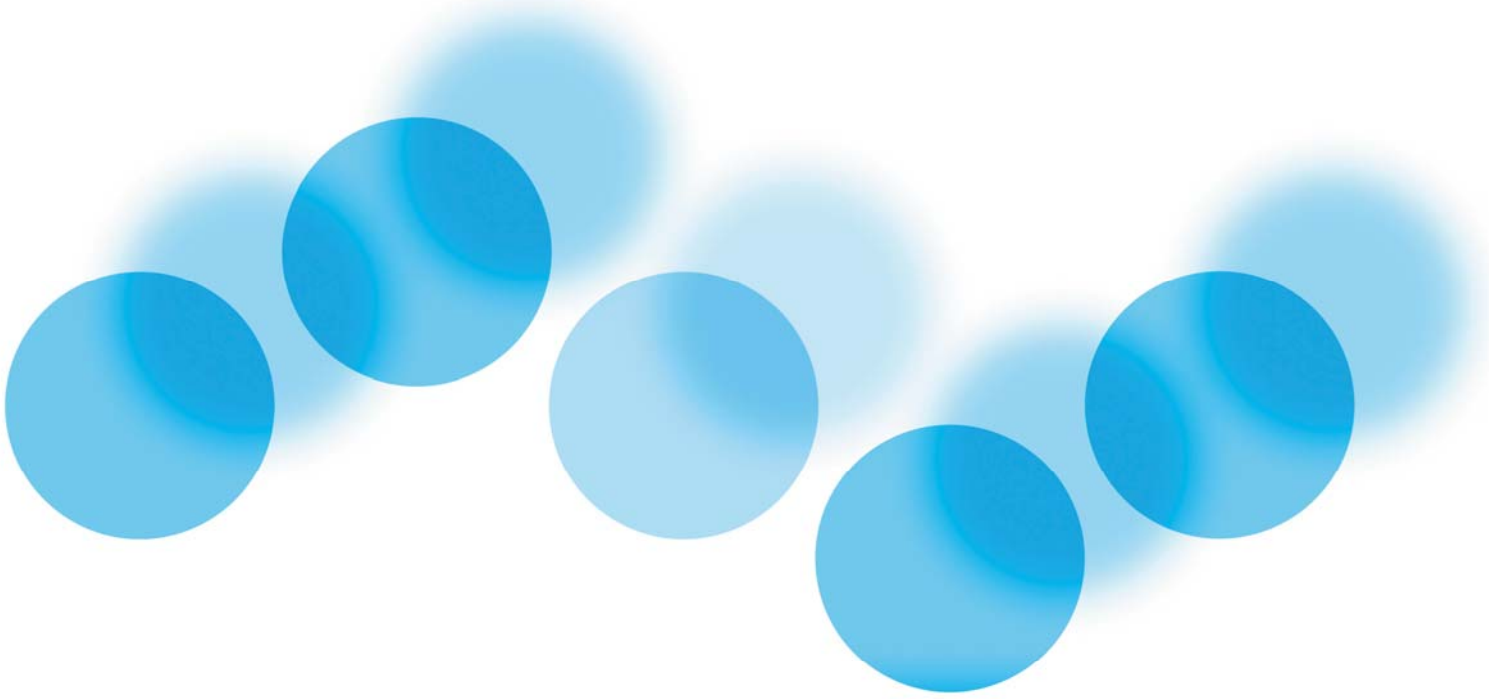
PROJECT

April 2006

REDUCTION OF POLLUTION RELEASES THROUGH AGRICULTURAL POLICY CHANGES AND DEMONSTRATION PROJECTS

Best Agricultural Practices – What It Is and How It Can Be Implemented



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WORKING FOR THE DANUBE AND ITS PEOPLE

UNDP I GEF
DANUBE
REGIONAL
PROJECT

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PREFACE

This document is prepared by the UNDP/GEF Danube Regional Project "Reduction of pollution releases through agricultural policy change and demonstration by pilot projects" and describes Best Agricultural Practices (BAP's), which could be implemented in the countries with the Danube River Basin within their territories.

The recommendations are intended for farm managers and their advisers.

The project has defined 15 BAP's, which in combination has a big positive effect on the farm production economy and in the same time would save the environment for a big load of nitrogen (N), phosphorus (P) and plant protection products (PPP), and therefore should be able to spread itself as good practices. One of the BAP practices require relatively big investments on the farms (manure stores), while another require availability of machine rings or similar services for spreading of livestock manure with optimal technology. The rest of the practices are cheap and can be implemented by all farms without consideration to their economy.

The defined 15 BAP's have been formulated on basis of the initial "Draft Concept for Best Agricultural Practice for the Danube River Basin Countries" as presented in the report "Recommendations for Policy Reforms for the Introduction of Best Agricultural Practice (BAP) in Central and Lower Danube River Basin Countries", the Final Report for the first Phase of the UNDP/GEF Danube Regional Project from February 2004. The report is available form the project homepage http://www.awt.co.yu/carlbro/index.htm.

The defined 15 BAP's does not attempt to be exhaustive, but rather to be some basic BAP's (from the blue zone in the mentioned report) that are relevant for all 7 project countries. Further, as this document is targeting farmers and their advisers, we are focusing on BAP's that are relevant on farm level – this excludes BAP's related with the processing industry, related with corruptive practices, related with national waste management plans, related with rules for registration of pesticides, etc., or in general excluding practices based on conditions outside farmers control. The 15 BAP's includes recommendations in the lower, intermediate and higher levels of the hierarchy of activities as mentioned in the first phase Final Report. We have additionally defined a few BAP's related with water saving measures, which we consider as basics for the feasibility of some other BAP's.

This is a working paper, latest updated 20 April 2006

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1. DEFINITION

Best Agricultural Practices (BAPs):

- have positive effects on the aquatic environment as well as on the farm production economy;
- are feasible and relevant in relation to the given climate, soil types, cropping and livestock patterns, legislation etc. of the region where it shall be applied, as well as feasible in relation to the economic strength of the individual farm;
- are opposite to bad agricultural practices, which pollutes the aquatic environment and deteriorate the production economy of the individual farm;
- are able to spread itself an be taken into use by farms in a voluntary way in the Danube River Basin due to the economic and environmental benefits; and
- are in line with EUs agricultural and environmental policies.

Related terms are

- Code of Good Agricultural Practices (CGAP), which has connection to EUs Nitrate Directive (676/91/EEC) and which only relates to nitrogen
- Common Standards of Good Farming Practice (GFP) - determined by Council Regulation 1257/1999/EEC (provisons concerning suport for rural development under the EAGGF), which determines that member states have to formulate "good farm practice" standards in their Rural Development Plan 2004-2006
- Statutory Management Requirements (SMR) - determined by EU Regulation 1782/2003/EEC, and is a set of 18 EU directives in the area of nature, agri-environment, food saftey and animal welfare
- Good Agricultural and Environmental Condition (GAEC) - determined by EU Regulation 1782/2003/EEC, and are regionally determined measures, which the farmers must observe concerning minimum standards for land management
- Best Available Technique (BAT) – determined by EUs Directive on Integrated Pollution Prevention and Control (IPPC) Directive 61/96/EEC – "shall mean the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole"

It is seen that the related terms all have connection with EU legislation. The Danube River Basin includes territories of the countries Ukraine, Moldova, Romania, Bulgaria, Croatia, Serbia & Montenegro and Bosnia & Herzegovina – none of them are member of EU. However, the BAPs which are presented in this document would be relevant to consider in connection to the elaboration of CGAP, GFP, SMR, GAEC and BAT, where this is relevant in the process of EU accession.

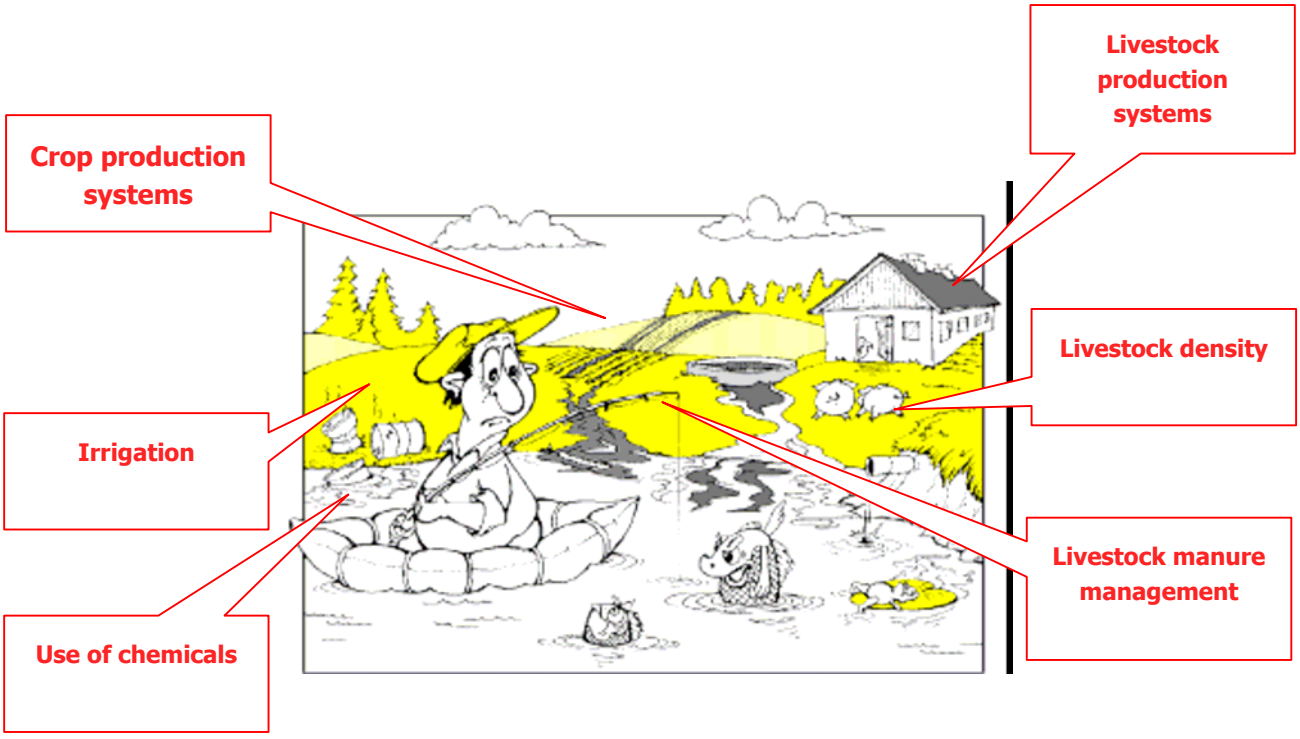
2. ENVIRONMENTAL PROBLEMS CAUSED BY AGRICULTURAL ACTIVITIES

The environment can be divided in water, soil, air and noise. Due to the relation of the BAP to the Danube River Basin we are here alone considering the water environment.

The water quality is especially influenced from agricultural activities by the load of nitrogen, phosphorus, and plant protection products:

- Nitrogen (or more precisely nitrate) cause for instance algae bloom in the marine waters, and "blue babies" (methemoglobinaemia).
- Phosphorus discharges causes eutrophication of especially fresh waters as rivers, lakes and streams. The euthrophication is accompanied by unpleasant nuisances and is endangering health of human and animal as some of the algae and phytoplankton produces highly toxic substances[iv].
- Residues of plant protection products have different hazardous effects, and can for instance cause disturbed human fertility.

Agriculture is not the only source of pollution, but the agricultural sector is typically on of the largest polluters. However, the management of the individual farm is directly influencing the level of the pollution from its activities.



Agricultural practices influence the quality of the water in the Danube River Basin

Best Agricultural Practices in relation to the influencing factors from the figure above is dealt with in the following, except irrigation.

3. RESOURCE ECONOMY

Nitrogen (N), phosphorus (P) and plant protection products (PPP) are not only potential hazardous agents for the aquatic environment. The other side of the story is that they are very costly, valuable and necessary input resources in the agricultural production.

- Nitrogen fertiliser (pure nitrogen) costs typically € 0.5 – 0.7 per kg
- Phosphorus fertiliser (pure phosphorus) costs typically € 1.0 – 1.4 per kg
- Herbicides costs typically € 20 to 150 per treatment per ha

The farmer has therefore a huge economic incentive to use the resources as efficient as possible.

Rich and prosperous farmers are simply those who have a good resource economy in general!

Calculation of green accounts is a simple way to reveal how efficient the available or purchased N, P and PPP resources are utilised on the farm.

<table>
<tr><td colspan="2">Best Agricultural Practice No 1
There should on all farms above 5 ha and/or 5 livestock be calculated resource economy every year, latest 1 April for the preceding year, and covering at least the resource economy for N, P and PPP.</td></tr>
<tr><td colspan="2">Estimated implications for the example farm described in Annex 1</td></tr>
<tr><td>Economic

<u>Expenses</u>

The calculation of N and P-balances and considering the consumption of PPP products, including the commenting and delivery of the analyses to the farmer would take an adviser 3 working days and cost € 75.

<u>Income</u>

No direct income, but revealing and quantification of possible problems.</td><td>Environmental

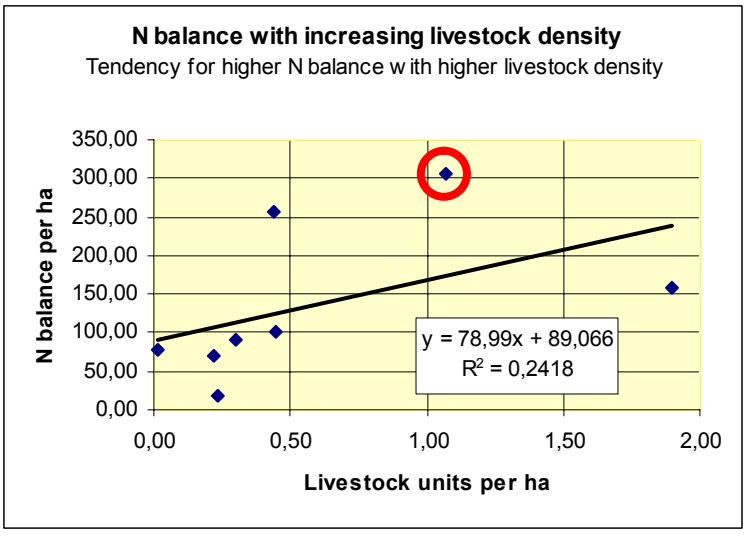
No direct environmental effects related with N, P or PPP, but clarification of the possibility for pollution reductions.</td></tr>
</table>

Green account or resource economy calculations reveals the efficiency of the use of natural resources or potential hazardous polluters of the environment, like plant nutrients, water, fuel, and pesticides.

Low efficiency = high pollution with such input factors is often quite visible, but the magnitude of the waste of money is often first becoming clear for the farmer after green accounts have been prepared.

It is fundamental for a good resource economy that plant nutrients in livestock manure are utilised as fertiliser for crops, and this can only happen if livestock manures are stored in adequate ways and not like on this picture, on the bare ground.

The following figure shows an analysis of the results of nitrogen balance calculations at 8 Serbian farms:



N-balance in 2005 for 8 Serbian farms

It is seen from the figure that there is a huge variation between farms – from 17 to 305 kg nitrogen per ha, and that there is a tendency for a higher balance with higher livestock density. (1 livestock unit = 1 cow = 100 kg N in livestock manure ex. storage).

Some of the farms can conclude that their nitrogen balance is OK.

The farm with a balance of 305 kg nitrogen per ha has an area of 100 ha, meaning that the farm pollutes the environment with 30,500 kg nitrogen per year. This is not only a problem for the environment; as nitrogen has a value of 59 dinar per kg (calculated on basis of the price of nitrogen fertiliser) it means that the farmer looses 1.8 million dinar per year in just nitrogen loss.

While the tendency line shows a low security it actually suits very well with similar calculations on other groups of farms: It is difficult to come under a balance of 50 kg nitrogen per ha, and the balance increases with increasing livestock density. Some of the farms with the lowest balances may temporarily over-exploit the soils. It is impossible to do farming without leaching of N, P and PPP to the environment, except for organic farming which would not leach chemical PPP: It is impossible to utilise the resources with 100% efficiency. However, it is possible through Best Agricultural practices to obtain a high efficiency of the input resources N, P and PPP.

When evidently too high balances are found, like for two of the farms on the above figure, there should be made investigations of the possible reasons:

- Livestock manure management: Insufficient storage capacity for livestock manure, livestock manure not part of fertiliser planning, too high livestock density on the farm, etc.
- Crop production system: Soil sampling and fertiliser planning is not performed, low share of winter green fields, bad livestock manure spreading technology, livestock manure not incorporated into the soil quickly after spreading, etc.
- Livestock production system: Balancing of feed rations is not done, poor forage quality, animals not fed according their needs, etc.

4. CROP PRODUCTION SYSTEMS

<table>
<tr><td colspan="2">Best Agricultural Practice No 2
Every farm with at least 1 ha of arable crops should ensure soil sampling at least each 5 years.</td></tr>
<tr><td colspan="2">Estimated implications for the example farm described in Annex 1</td></tr>
<tr><td>Economic
<u>Expenses</u>
€ 10 per field per 5 years.
<u>Income</u>
None</td><td>Environmental
No direct environmental effect, but creates the basis for fertiliser planning.</td></tr>
</table>

The results of soil analyses shall be used for the field and fertiliser planning, and a set of correction factors must be available for this - see Annex 3, tables 5, 6, 7 and 8.

Soil sampling – soil analyses makes fertilising more precise

Best Agricultural Practice No 3 Crop rotation and fertilising plans should be prepared for all farms above 5 ha every year latest 31 March, for winter crops latest 1 August. Fertilising plans shall be based on the expected yield level, the needs of the crops, and include both livestock manure and mineral fertiliser.	
Estimated implications for the example farm described in Annex 1	
Economic <u>Expenses</u> Would take an adviser 2 working days (€ 50) if it is the first time for the farm, and else 1 working day (€ 25). <u>Income</u> 10 % increase in the field effect of the N and P, which has a value of € 915.	**Environmental** 1,036 kg N 397 kg P

Field and fertiliser plans have 2 winners: The farmer is a winner because the plans make him able to obtain an optimal production economy because the use of the expensive plant nutrients in this way is optimised. The environment is a winner because the plans ensures the nitrogen and phosphorus is distributed in a balanced way and therefore utilised by the crops rather than leached to the environment, where they can do much harm to the aquatic environment.

Modern field and fertiliser plan programmes are based on fertiliser norms that limit the fertilising to the needs of the crop, and furthermore reduces the application of fertilisers to the economic optimal productivity target.

A basic principle must be that livestock manure first of all is distributed in order to fulfil the crops need for fertilising, and that mineral fertiliser only is used for covering of the difference between the norm and the contribution from livestock manure.

Livestock manure management is therefore a central part of fertiliser planning in compliance with EU's legislation; a field and fertiliser plan programme must therefore be able to keep a precise

calculation of the production and use of livestock manure, here under keep track of the stores, and a manure standard is an imperative part of the normative tables in the program. A good program can also handle the variation in field effect dependent on time and method for application of the livestock manure to the crops.

The main output of a field and fertiliser plan program is an overview of the fields and which fertilisers that should be distributed per ha and per field, and at which time of the year. Other outputs can for instance show the field details with field history, green fertilisers, previous distribution of livestock manure, sown varieties, soil parameters, etc., and analyses can show the area of winter green fields, the average field effect of nitrogen in livestock manure, etc.

Fertiliser plans should be made on basis of a determined methodology and connected normative tables. The normative tables includes

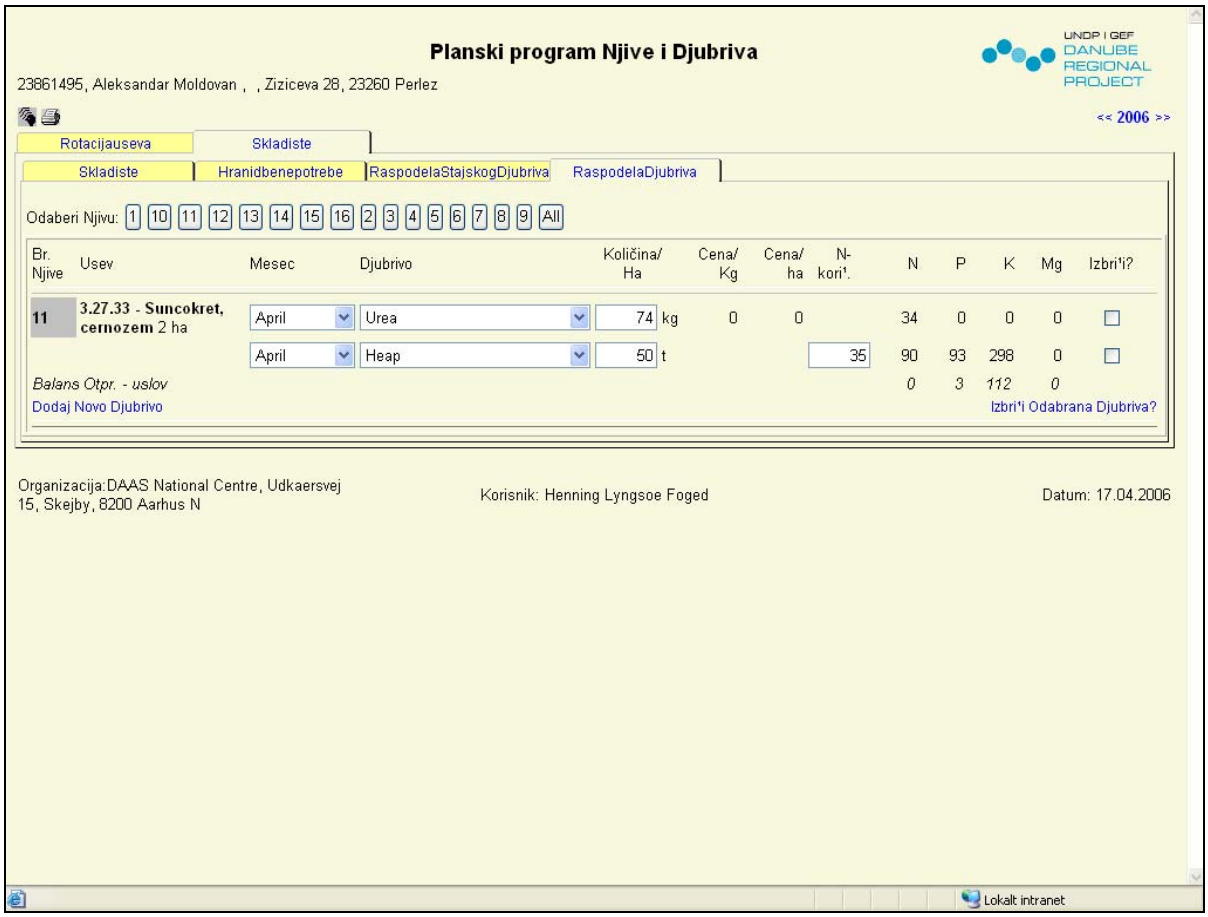
- norms for fertilising of crops (see table 3.1 to 3.9);
- norms for livestock manure (see table 2); and
- normative correction factors for soil analyses, expected yield levels, after effect of previous crops, after effect of previous livestock manure spreading, and effect of green manure.

The following Table 1 gives a general overview of the steps of calculation of crops nutrient requirement for N, P, K and Mg.

Table 1: Overview - steps in calculation of nutrient demand.

Step No.	Type	Table	Calculation of demand for			
			N	P_2O_5	K_2O	MgO
1	Standard demand	3.1	Yes	Yes	Yes	Yes
Correction for:						
2	Yield	3.1	Yes	Yes	Yes	Yes
3	Soil texture	3.2	Yes	Yes	Yes	No
4	Humus	3.3	Yes	No*	No*	No
5	Soil acidity – Ph	3.4	Yes	Yes	Yes	No
6	Soil analyses	3.5	No	Yes	Yes	No
7	Previous crop	3.6	Yes	No	No	No
8	Green manure	3.7	Yes	No	No	No
9	Animal manure	3.8	Yes	No	No	No
10	Nutrient balance	3.9	No	Yes	Yes	No

* Possible if needed. See table 3.3 in Annex 3.



Balancing screen of a Serbian field and fertiliser plan program – balancing is done on basis of available livestock manure and commercial mineral fertilisers. Imbalances in individual fields should be taken into account in next years balancing, meaning that the shown field should not be fertilised with K in the next years.

5. LIVESTOCK PRODUCTION SYSTEMS

Best Agricultural Practice No 4 Livestock should be fed with rations that are correct balanced with energy, protein and minerals in relation to the productivity.	
Estimated implications for the example farm described in Annex 1	
Economic <u>Expenses</u> Would take an adviser 1 working day 5 times per year and cost € 125, and it is necessary with milk recording, which costs € 15 per cow per year. <u>Income</u> 15% increased productivity with the same feed costs, estimated to have a value of € 20,000.	**Environmental** Would reduce the content of N and P in the manure with 15%, but with 15% increased productivity the amounts of manure would we increased with 15% as well, therefore no effects.

Typically norms for feeding of animals describe the needs for energy, protein, Ca and P as the most important factors. Nitrogen is bound in protein in feeds. The most limited factor will decide the production level, and if there is a misbalance between the factors there will be a low feed efficiency in general.

The following figure shows a typical example of the annual turn over of nitrogen, phosphorus and potassium in feeding of a dairy cow:

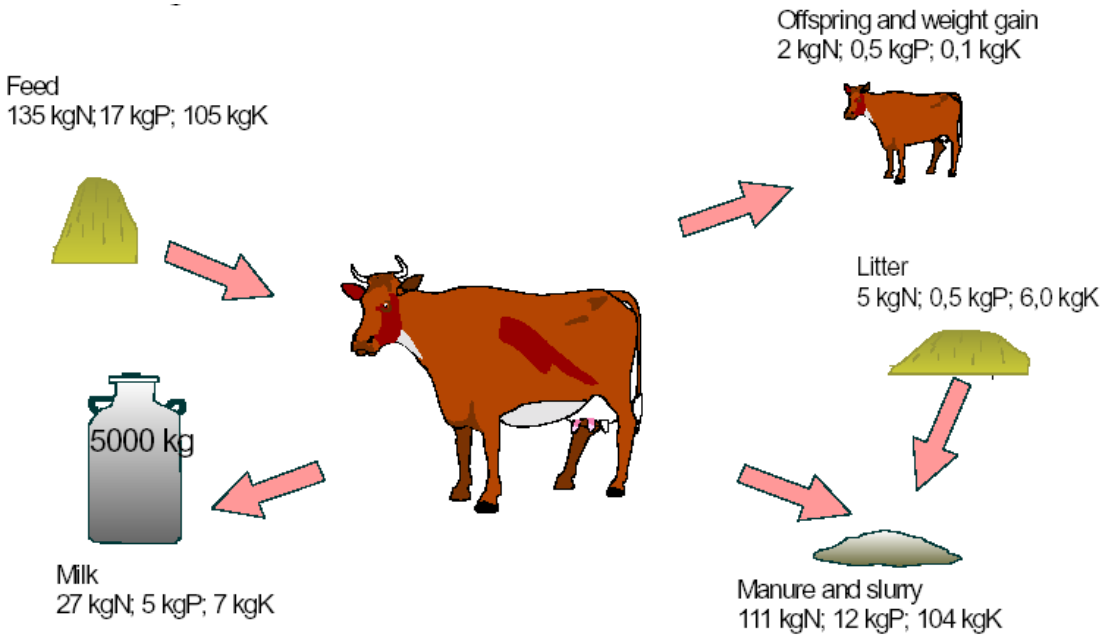


Figure 1: Turnover of N, P and K for a dairy cow yielding 5,000 kg milk per year. N, P and K for the offspring are only related with production of foetus.

If, for instance the cow is given 14 Kg or around 20% less phosphorus than needed for a production of 5,000 Kg milk, then the utilisation of N (protein) (as well as K and other things) will be 20% under optimum, and around 27 Kg N is wasted. Much can of course be found in the urine and the manure.

Best Agricultural Practice No 5 Cleaning of stables with water should be avoided or reduced to a minimum.	
Estimated implications for the example farm described in Annex 1	
Economic Expenses None direct expenses, but could require use of alternative cleaning systems, possible demanding investments in rebuilding of stables. Income Saved water consumption costs. Saved costs for handling and storing of livestock manure.	**Environmental** No direct effects, but pre-condition for use of the livestock manure as fertiliser for the crops.

Best Agricultural Practice No 6 Watering of the livestock should happen in a way that hinders spill of water.	
Estimated implications for the example farm described in Annex 1	
Economic Expenses Replacement of old drinking nipples. Income Sawed water consumption costs. Saved costs for handling and storing of livestock manure.	**Environmental** No direct effects, but pre-condition for use of the livestock manure as fertiliser for the crops.

6. LIVESTOCK DENSITY

Best Agricultural Practice No 7 There should maximally be livestock corresponding to a nitrogen content in the manure of 170 kg N per ha. Manure should be sold to other farms or distributed to fields of other farms in case of a higher livestock density.	
Estimated implications for the example farm described in Annex 1	
Economic <u>Expenses</u> None – making agreement with neighbour. <u>Income</u> None.	**Environmental** 1,858 kg N 713 kg P

There should be harmony between the number of livestock on the farm and the area in crop rotation which can be fertilised with the livestock manure. It is difficult to utilise the fertilising effect of manure if more than an amount equal to 170 kg N per ha is applied to the fields.

Table 2: Manure standard. All figures are express amounts and quality ex. storage. In this example the normative values are not divided on solid and liquid part, which would be preferable for dimensioning of manure stores.

Id	Livestock type	Productivity level	Housing system	Bedding type	Tonnes	kg N/t	kg P/t	kg K/t	kg P2O5/t	kg K2O/t	N total	P total	K total
1	Sows	20 weaned piglets per sow per year of 7.5 kg	Solid floors with straw bedding, including marginal separate collection of urine	Straw	3,8	6,2	2,1	3,8	4,8	4,5	23,6	8,0	14,3
2	Sows	20 weaned piglets per sow per year of 7.5 kg	Partly or fully slotted floors	Sawdust or nothing	6,8	4,6	1,3	1,8	3,0	2,2	31,1	8,8	12,2
3	10 piglets produced	From 7.5 to 25 kg	Solid floors with straw bedding, including marginal separate collection of urine	Straw	1,1	4,3	1,5	3,5	3,4	4,2	4,7	1,7	3,8
4	10 piglets produced	From 7.5 to 25 kg	Partly or fully slotted floors	Sawdust or nothing	1,6	4,4	1,2	2,2	2,7	2,6	7,2	2,0	3,6
5	10 fatteners produced	From 25 to 105 kg	Solid floors with straw bedding, including marginal separate collection of urine	Straw	5,3	5,1	1,4	3,6	3,3	4,3	26,5	7,6	18,7
6	10 fatteners produced	From 25 to 105 kg	Partly or fully slotted floors	Sawdust or nothing	6,1	5,6	1,2	2,7	2,7	3,3	34,3	7,4	16,5
7	Dairy cows	6,000 kg milk per cow per year	Solid floors with straw bedding, including marginal separate collection of urine	Straw	15,5	5,1	1,0	5,5	2,3	6,6	79,1	15,5	85,3
8	Dairy cows	4,000 kg milk per cow per year	Solid floors with straw bedding, including marginal separate collection of urine	Straw	12,0	5,1	1,0	5,5	2,3	6,6	61,2	12,0	66,0
9	Heifers	From 6 months to calving, 700 gram daily gain	Solid floors with straw bedding, including marginal separate collection of urine	Straw	5,5	5,3	1,1	5,7	2,5	6,9	29,2	6,1	31,4
10	Calves	Up to 6 months age, 800 gram daily gain	Solid floors with straw bedding, including marginal separate collection of urine	Straw	1,7	5,6	1,8	2,5	4,1	3,1	9,5	3,1	4,3
11	Bulls for slaughter	From 6 months age to 450 kg, 450 g,	Solid floors with straw bedding, including marginal separate collection of urine	Straw	3,5	6,5	1,4	4,0	3,2	4,8	22,8	4,9	14,0
12	Suckler cows with calves	1 calf per year, continental breed	Solid floors with straw bedding, including marginal separate collection of urine	Straw	9,8	5,5	1,0	6,5	2,3	7,8	53,9	9,8	63,7

Id	Livestock type	Productivity level	Housing system	Bedding type	Tonnes	kg N/t	kg P/t	kg K/t	kg P2O5/t	kg K2O/t	N total	P total	K total
13	Horses	600 kg live weight	Solid floors with straw bedding, including marginal separate collection of urine	Straw	5,1	8,3	1,8	13,4	4,1	16,1	42,3	9,2	68,3
14	Sheep	2 lambs per year, 150 gram daily gain	Solid floors with straw bedding, including marginal separate collection of urine	Straw	1,2	12,3	2,7	31,0	6,2	37,3	14,8	3,2	37,2
15	100 laying hens		Battery system, manure removal without adding of water	-	10,0	6,5	2,2	2,6	5,0	3,1	65,0	22,0	26,0

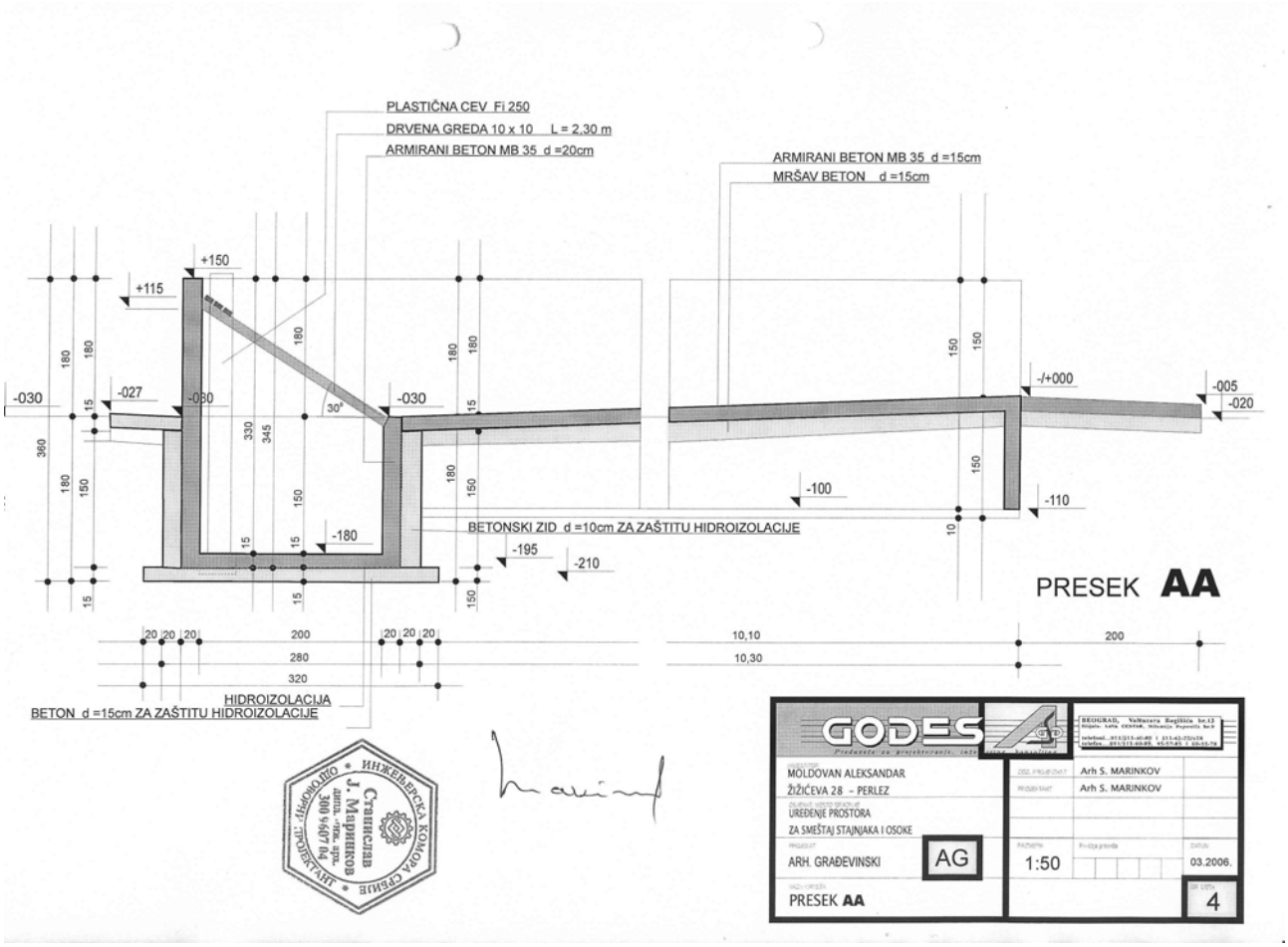
7. LIVESTOCK MANURE MANAGEMENT

Best Agricultural Practice No 8

There should be storage capacity for at least 6 months production of livestock manure at the farm. Production systems with use of bedding material needs storage capacity for both liquid and solid manure. Production systems with deep bedding can store the manure on the field for up to 6 months if the manure has a dry matter content of minimum 30%.

Estimated implications for the example farm described in Annex 1

Economic	**Environmental**
<u>Expenses</u> Required storage capacity of 2000 m^3, of an investment price of € 100 per m^3 or in total € 200,000, which with depreciation over 15 years and gives annual costs of roughly € 15,000. <u>Income</u> Possibility to use the livestock manure as fertiliser for the crops. The manure storage contributes to increase the field effect with 20%, which has a value of € 1,830.	2,072 kg N 794 kg P



Example of a separation manure store for farms, who do not have drains for separation of the liquid part in the stable and therefore must separate the fractions in the storage (NB: this drawing must not be published but replaced with a corrected one according my comments.

Best Agricultural Practice No 9 It must be hindered that rain water can dilute the livestock manure.	
Estimated implications for the example farm described in Annex 1	
Economic <u>Expenses</u> Lit on the slurry tank costs an extra investment of 50% = € 5,500 annually. Collection of rain water costs for instance € 500. <u>Income</u> Saved costs for transport of slurry to the fields.	**Environmental** No effects on N, P and PPP

Best Agricultural Practice No 10 Spreading of manure in the period from 15 October till 1 March should not take place, and in any case not on to frozen land or land with a slope of more than 7°.	
Estimated implications for the example farm described in Annex 1	
Economic <u>Expenses</u> None, but require the manure storage. <u>Income</u> The spreading at the correct time contributes to increase the field effect with 10%, which has a value of € 915.	**Environmental** 1,036 kg N 397 kg P

Best Agricultural Practice No 11 Proper technology should be used for spreading of livestock manure. Liquid manure and slurry should be spread with band laying system or be injected into the soil.	
Estimated implications for the example farm described in Annex 1	
Economic <u>Expenses</u> Not more expensive than other spreading methodologies. <u>Income</u> The spreading of livestock manure with use of optimal technology contributes to increase the field effect with 20%, which has a value of € 1,830.	**Environmental** 2,072 kg N 794 kg P

Proper equipment for spreading of livestock manure is very expensive and requires a large production to utilise cost efficiently. A good solution for family farms is to own and utilise such equipment jointly on basis of an agreement as outlined in Annex 4.

Best Agricultural Practice No 12 Livestock manure should be incorporated into the soil within 6 hours.	
Estimated implications for the example farm described in Annex 1	
Economic Expenses Not necessary of the slurry is spread with optimal technology. In any case no expense. Income Probably contribute to increase the field effect with 5%, which has a value of € 400.	**Environmental** 518 kg N 199 kg P

8. USE OF CHEMICALS

Best Agricultural Practice No 13 Spaying should be done according to the needs, and the doses take into consideration the spraying time, the development stage of the crop, the climatic conditions.	
Estimated implications for the example farm described in Annex 1	
Economic Expenses Require crop protection planning, for instance 2 hours of work. Income Reduce the dosis to 25% of prescribed levels from the producer. With 2 sprayings of herbicide on 20 ha the savings are 75% times 35 € per ha per time times 2 sprayings per season times 20 ha = € 1,050.	**Environmental** 75% reduced use of PPP, equal to for instance 20 litre (dependent on PPP agent)

Best Agricultural Practice No 14 The spraying equipment should function properly, and it shall be ensured that the nozzels are functioning well to ensure an even spraying.	
Estimated implications for the example farm described in Annex 1	
Economic <u>Expenses</u> Test of sprayer would take an adviser ½ day. Renovation of the sprayer costs for instance € 500, or € 100 per year. <u>Income</u> None directly, but a pre-condition for use of reduced doses.	**Environmental** None directly.

Flow-metre for simple and quick test of the yield of sprayer nozzles

Best Agricultural Practice No 15 PPP means shall be kept in a locked store, where books are kept on the purchase and use of PPP.	
Estimated implications for the example farm described in Annex 1	
Economic Expenses Would cost for instance € 500, or € 35 per year if it is depreciated over 15 years. Income None directly.	**Environmental** None directly.

ANNEX 1 DESCRIPTION OF EXAMPLE FARM

Crop production	Area	50 ha
	Fields	Cultivated fields with crops of soybean, sunflower, wheat, and other cash crops – 2 fields of each 10 ha
		Maize – 2 fields of each 10 ha
		Permanent pasture – 1 field of 10 ha
	Yield level	Moderate
Livestock production	Livestock	Dairy cows – 50
		Dairy heifers (6-24 months) – 40
		Calves (0-6 months) – 15
		Slaughter bulls – 25
		Sows – 75
		Weaners produced per year – 1,250
		Fatteners produced per year – 1,250
	Yield level	Moderate
Production system	Manure type	Pumpable, with minimum of straw bedding
	Grazing	Cows and heifers from 15 April till 15 November (210 days)
	Manure storage	None
	Disposal of manure	Wherever it is possible to dump it.
	Green accounts	No
	Soil analyses	No
	Crop and fertiliser planning	No
	Feeding planning	No
	Water saving measures	No
	Proper manure spreading equipment	No
	Crop protection planning	No
	Renovated field sprayer	No
	Locked store for PPP	No
Produced fertilisers in livestock manure	N	10,358 kg
	P	3,972 kg
	N-balance	207
	P-balance	79

ANNEX 2 SUMMARIZING OF ECONOMIC AND ENVIRONMENTAL EFFECTS OF BAPS ON THE EXAMPLE FARM

BAP no.	BAP	Total per year, €		Amount of reduced leaching, kg		
		Costs	Income	N	P	PPP
1	Green accounts one time per year	75				
2	Soil analyses one time per 5 years	10				
3	Crop rotation and fertiliser planning one time per year	25	915	1036	397	
4	Feed balancing minimum 2 times per year	875	20000			
5	Renovation of stables to avoid cleaning of stables with water					
6	Renovation of watering nipples and alike to avoid spill of water in the stable					
7	Maximally 170 kg N in livestock manure per ha			1858	713	
8	Minimum 6 months storage capacity for livestock manure	15000	1830	2072	794	
9	Rain water is collected separately to avoid diluting of livestock manure with rain water					
10	No spreading of livestock manure in the wintertime or on frozen or sloping fields		915	1036	397	
11	Use of proper livestock manure spreading technology (especially for liquid manure)		1830	2072	794	
12	Incorporation of livestock manure into the soil before 6 hours after spreading (for broad-spread manure)		400	518	199	
13	Crop protection planning and use of reduced doses		1050			20 litre
14	Test and renovation of field sprayer minimum once per 5 years	100				
15	Installation of locked store and book-keeping of purchase and use of PPP	35				
TOTAL		**16.120**	**26.940**	**8.592**	**3.294**	**20**
Balance after implementation of BAP's				**35**	**14**	

ANNEX 3NORMATIVE TABLES FOR FIELD AND FERTILISER PLANNING

Table 3.1: Standard demands for N, P and K. Example.

Code	Crop	Standard		Correction kg per 1 t.			Demand for standard yield			Trial results average	
		Yield	Unit	N	P	K	N	P	K	$N_{optimum}$	Yield
1	Winter rye	4,4	t/ha	21	10	25	**95**	**45**	**110**	98	43
2	Winter wheat	4,8	t/ha	23	12	20	**110**	**60**	**95**	101	67
3	Spring wheat	4,4	t/ha	22	7	20	**95**	**35**	**90**	92	44
4	Spring barley	4,4	t/ha	21	9	21	**95**	**40**	**90**	96	43
5	Oats	3,5	t/ha	24	11	21	**70**	**40**	**75**	67	35
6	Sugar beet	40	t/ha	3	2	4	**125**	**60**	**160**	146	400
7	Potatoe	26	t/ha	4	2	6	**120**	**60**	**145**	128	260
8	Flax (for fibre)	7	t/ha	6	5	10	**40**	**35**	**70**	32	74
9	Perrenial grasses, leguminous	6	t/ha		5	24		**30**	**140**		
10	Perrenial grasses, cereals, d.m	6,8	t/ha	18	5	20	**120**	**35**	**130**		
11	Spring rape seed	2	t/ha	40	20	37	**90**	**60**	**100**		
12	Winter triticale	4,5	t/ha	22	11	22	**100**	**75**	**130**		

Table 3.2: Correction factors for different soil texture classes. Example.

Nutrient	Soil type	Correction factor
N	Sand	1,10
N	Loamy sand	1,00
N	Loam	0,95
N	Clay	0,90
N	Peat	0,60
P	Sand	1,00
P	Loamy sand	1,00
P	Loam	1,00
P	Clay	1,00
P	Peat	1,10
K	Sand	1,10
K	Loamy sand	1,00
K	Loam	0,95
K	Clay	0,90
K	Peat	1,00

Table 3.3: Correction factors for contents of humus in soil. For P and K the correction factor is 1 for all values of humus pct., which means there is no correction. Example

Nutrient	Humus, pct.	Correction factor
N	<1,5	1,10
	1,5-2,5	1,00
	2,5-5,0	0,90
	5,0-10	0,85
	10-20	0,80
P	<1,5	1,00
	1,5-2,5	1,00
	2,5-5,0	1,00
	5,0-10	1,00
	10-20	1,00
K	<1,5	1,00
	1,5-2,5	1,00
	2,5-5,0	1,00
	5,0-10	1,00
	10-20	1,00

Table 3.4: Correction factors pH values. Example.

Nutrient	pH	Correction factor
N	<5,0	1,10
	5,0-5,5	1,10
	5,5-6,0	1,05
	6,0-6,5	1,00
	6,5-7,0	1,00
	>7,0	0,95
P	<5,0	1,10
	5,0-5,5	1,10
	5,5-6,0	1,05
	6,0-6,5	1,00
	6,5-7,0	1,00
	>7,0	0,95
K	<5,0	1,10
	5,0-5,5	1,10
	5,5-6,0	1,00
	6,0-6,5	1,00
	6,5-7,0	1,00
	>7,0	0,95

Table 3.5: Correction factors for P and K according to soil analysis. Example.

Nutrient	Soil status	Correction factor
P	Very low	1,4
	Low	1,0
	Medium	0,7
	High	0,5
	Very high	0,3
K	Very low	1,3
	Low	1,2
	Medium	1,0
	High	0,7
	Very high	0,5

Table 3.6: Correction of nitrogen demand according to after-effect of previous crop, kg N pr. ha. Example.

Nutrient		Correction factor
N	Cereals	0
	Peas	-15
	Potatoes	0
	Rape seed	-10
	Clover	-20
	Alfalfa	-30
	Graminaceous	-10
	Maize	0
	Sugar beet	-10

The nitrogen after-effect from green manure is determined by using the factors of decomposition, which are shown in Table 3.7. The calculated mineralisation replaces nitrogen in mineral fertilizer.

Table 3.7: Mineralisation constants for different types of crop residues. Percent of remaining organic N. Example.

	1. Year	2nd Year	3rd Year
Straw from cereals	0	10	1
Straw from peas	25	20	5
Green manure, Sinapis Alba	50	20	5

The nitrogen after-effect from animal manure is determined by using the decomposition factors shown in Table 3.8. The values in table 3.8 are valid under conditions where animal manure has been applied very often in the last 10 years period. Where animal manure is applied for the first time mineralisation values are lower. The calculated decomposition replaces nitrogen in mineral fertilizer.

The mineralisation constants in table 3.9 are calculated under the consideration that that the decomposition of organic matter in animal manure follows the same pattern irrespective if it is in slurry, manure etc. The decomposition of the organic matter (percent of amount applied per year) is considered to be:

- 1. year: 25
- 2. year: 8
- 3. year: 3
- > 4 years: 0 - 1

When calculating the mineralisation constant in percent of applied total N, it is taken into account what the share of organic N is.

Table 3.8: Mineralisation constants for different types of animal manure. Example.

Type of organic matter	Organic N	Total N	Mineralisation, pct. of total N	
	Kg per t	Kg per t	2nd year	3rd year
Organic 1 (solid manure from cattle)	5	6	13	10
Organic 2 (deep litter)	4	6	10	7
Organic 3 (solid manure from pigs)	3	6	7	5
Organic 4 (slurry)	2	6	4	3
Organic 5 (liquid manure)	1	6	1	1

Example: If 30 t of animal manure of the type "organic 1" was applied per ha. in spring the year before then the nitrogen after-effect is: 30 * 6 * 0.13 = 23 kg N per ha.

Table 3.9: P and K balances. Example.

The demand for P and K is corrected according to the P- and K-balance in the previous crop. The balance is calculated as the difference between the supply and the removal of P. The effect on the P- and K-demand in the following crop is 50 pct. of the positive balance in the previous crop. A negative balance does not lead to an increase in the demand for either P or K. Example:

PREVIOUS CROP (balance calculation):	P	K	
Application	35	222	
- Removal		25	277
= Balance	+10	-55	
CROP (application demand):	P	K	
Standard demand	25	60	
Correction for positive balance		-5	0
Demand, calculated	20	60	

ANNEX 4 STANDARD AGREEMENT FOR JOINT OWNERSHIP AND USE OF FARM MACHINERY

AGREEMENT

on

joint ownership and cooperation about farm machinery

Clause 1

Signatories

_____, _____, _____ and _____ (in the following: Signatories) have today entered into this Agreement.

Clause 2

Purpose

The purpose of this Agreement is to regulate the joint ownership and cooperation about use of farm machinery.

Clause 3

Share of ownership

The share of ownership in each of the machines is variable from machine to machine. The share of each Signatory is agreed on the acquisition, however, conferring to Clause 5.

Agreement is necessary on acquisition of new machines.

Finance of new machines under this Agreement is made by each of the Signatories.

Clause 4

Liability, receipts and expenses

Receipts and expenses for each of the machines are distributed for each one of the machines according to share of ownership, however, conferring to Clause 5.

The Signatory who causes any damage to a machine under this agreement pays for the reparation expenses. If the value of the machine is improved during the reparation, then this improved part is shared between the Signatories according to their share of ownership.

Clause 5

If the area of one of the Signatories is extended or reduced, the Signatory has to pay, according to the changes in area, a proportionally bigger or smaller share in the maintenance costs and depreciation for the implicated machines.

If any of the Signatories area is extended by more than 30%, the other Signatories can demand that the Signatory with the extended area takes over a bigger share of ownership of the implicated machines.

The demand for a bigger share of ownership has to be made in writing within 3 months after the other Signatory has been informed about the extended area.

The price fixed for the transfer is that the machines from the date of acquisition and 10 years ahead are depreciated straight-line by 10% per annum to a value of zero.

Clause 6

The Signatories liability is only a joint and several liability when this is agreed upon, or if one of the Signatories has been legitimated to act on behalf of the co-ownership.

In case one of the Signatories has discharged outstanding liabilities of the co-ownership, including paying of outlay for the co-ownership, the mentioned Signatory has the right to immediate proportionate repayment from the other Signatories.

The debtor is obliged to pay interest of the non-payments 8 days after a written demand from the other Signatory. The interest is the discount rate plus 4%.

Non-payment of the above mentioned amount is to be perceived as an essential breach of the Agreement of co-ownership if the amount has not been paid within 2 weeks on written demand from the other Signatory.

Clause 7

The Signatories joining and outgoing

With accept of all Signatories new Signatories can be admitted on the condition that these accept the terms stipulated in this present Agreement.

Clause 8

One of the Signatories can for one or more machines cancel his participation in the co-ownership at 3 months notice, however, the expiry can only take place in the period from 1/1 to 28/2.

If one of the Signatories sells his farm, conferring to Clause 2, he can always cancel his participation at 6 months notice for expiry at the end of a month.

The co-ownership comes to an end according to the conditions stipulated in Clause 13.

Clause 9

The transfer of the share of ownership can only take place with accept of all Signatories.

In case one of the Signatories dies or has been declared incapable of managing his own affairs, the husband/wife of the mentioned Signatory has, however, always the right to join the Agreement. The notice about joining the Agreement shall be stated in writing and given to the other Signatory

not later than 3 months after the Signatory in question has received the notice about the incapability of affairs or death.

If the husband/wife does not want to join the Agreement, then the joint co-ownership stops irrespective of what is put down in Clause 8, with effect at the end of the calendar year, in which the Signatory died or has been declared incapable of managing his own affairs or immediately after the mentioned 3 months notice.

The husband/wife joining the Agreement receives the same rights and duties as the outgoing Signatory.

In case of discontinuation the co-ownership comes to an end according to the terms stipulated in Clause 13.

Clause 10

The co-ownership stops without any further notice if one of the Signatories goes bankrupt, irrespective of Clause 8, with effect at the end of the calendar year.

The discontinuation of the co-ownership happens according to the terms stipulated in Clause 13.

Clause 11

Planning of right of use and maintenance, etc.

The Signatories have a meeting as often as required. At the end of March they exchange crop plans. In this way the Signatories have the possibility of planning the coming season together.

A decision report is made on the agreed terms at the meetings.

The Signatories can in complete agreement rent the co-owned machines to work as a machine pool for others. The rent is fixed in complete agreement for each machine.

According to share of ownership the Signatories have the right to use the machines.

A Signatory has an obligation to inform the other Signatories in case a machine is not in use during the period where a Signatory has the right to use the machine. In such cases it can be agreed that one of the other Signatories use the machine instead.

A machine is picked up by the Signatory, who wants to use the machine. A machine can be picked up or delivered only at _____or _____. Machines under this agreement have to be delivered in a good order, ready for use.

The preparation for the winter and storage takes place according to the joint ownership.

Clause 12

Default

If one of the Signatories has violated an obligation towards the joint ownership or the other Signatories seriously, the other Signatories can, regardless of Clause 8, in a written notice cancel the agreement of joint ownership in the whole. The cancellation takes place at one months notice to the end of a calendar month.

The decision to cancel the joint ownership because of default shall be given in a written notice to the defaulter within a month after the Signatory, who is cancelling, has learned about the default.

The cancellation takes place according to the terms stipulated in Clause 13.

In case of default the defaulter has to pay a fine amounting to Dinar _____. The fine is indexed as to the net consumer-price index based on the value of Dinar per 1/1 2006. The fine goes to the other Signatories. Default based on the inability to pay, according to Clause 6, is not comprised by the fine.

The settlement of the fine does not excuse from the obligation to pay the compensation, and if one Signatory has caused the other Signatory or the joint ownership a loss, the one in question is responsible for the loss according to the Serbian laws common regulations for damages.

Clause 13

Ceasing

The joint ownership ceases to exist in whole or in part when this is decided according to the Clauses 8, 10 and 12, or when it is agreed upon by the Signatories.

Having the termination date as the date of completion, the joint ownerships accountant makes a final settlement. The final settlement comprises all rights and obligations.

The price for one or more of the joint farm machines is set by the Signatories in a closed envelope making their bid for one or more of the machines. Together with the joint ownerships accountant the bids are opened. The highest bidder has the obligation to buy. For each machine is a separate bid. Each one of the Signatories has got the right to invite a third party to make his bid.

The settlement from the accountant has to be ready within 4 weeks from the termination date.

Clause 14

Accounts

The Signatories appoint an accountant.

The joint machinery co-ownerships accounting year is the calendar year.

For each one of the machines separate accounts are kept, in which both receipts and expenses are included.

Profit and loss for each of the machines are distributed according to share of ownership, according to Clause 4 or the actual application, according to Clause 5.

A profit is distributed to the Signatories within 2 weeks after the completion of the accounts.

A loss is also to be settled within 2 weeks after the completion of the accounting year.

Clause 15

Insurance

The joint machinery co-ownership takes out the necessary and relevant personal property insurance and liability insurance.

The insurance premium is distributed according to the share of ownership.

Clause 16

Disputes/arbitration

Disputes between the Signatories concerning the interpretation of the present agreement or

concerning the Signatories cooperation in view of the present agreement are to be settled finally by an arbitration tribunal.

The arbitration tribunal is performed by one or two impartial experts.

In case no agreement is reached about having only one arbitrator, the Signatories each appoint one.

When one of the Signatories has chosen his arbitrator and informed the other Signatory, and the other Signatory within a week has not appointed his, the first Signatory is entitled to have the judge in civil cases in _____ appoint the other arbitrator.

Before starting the transaction the arbitrators can appoint a third arbitrator. If no agreement can be reached, the third arbitrator is appointed by the judge in _____.

Each of the Signatories has the right to make comments in writing twice and does only have a fortnight each time to make the comments, unless the arbitrators are granting an extension of time.

If the deadline is disregarded the Signatory in question has lost his right to make further comments. Moreover, it is up to the arbitration itself to decide its procedure, including which supplementary documents it may want to be procured.

When the arbitrators have reached the stage of judgment, they are obliged to return a verdict within four weeks. If not so each of the Signatories has the right to reject the arbitration and demand the dispute to be settled in court.

The arbitrators determine who should pay the costs involved with the case.

The verdict ends the case completely and the case can therefore not be brought before the ordinary courts.

If questions to the understanding or meaning of this clause arise, the clauses of the arbitration law apply.

Any modification of the terms of this Agreement require accept of all Signatories. Any modification has to be written on a supplement to this Agreement, signed by each Signatory and attached to this Agreement.

If a practice is set on the conditions of the co-ownership, the practice can at any time be cancelled by each one of the parties. The notice of termination is to be made in writing to the other Signatories, and is binding on all future decisions.

Accepted on the date_____

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AA BB

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CC DD

WORKING FOR THE DANUBE AND ITS PEOPLE