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FARMING SYSTEMS RESEARCH UNIT

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CONSTRAINTS AND RESEARCH NEEDS FOR LIVESTOCK PRODUCTION IN UPPER VOLTA

Prepared by

Charles L. Rhykerd

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FARMING SYSTEMS RESEARCH UNIT PROJECT

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submitted by

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ITINERARY

July 14 (Saturday), 1984	— Left Lisbon, Portugal at 14:45
July 15 (Sunday)	— Arrived in Ouagadougou at 8:05 am
July 16	— Meeting with Dr. Herb Ohm, Dr. Joe Nagy, and Mr. Chris Pardy
July 17	— A.M. Meeting with Ms. Chantal Zoungrana, animal nutritionist with the Ministry of Rural Development P.M. Meeting with Mr. Francois Abou, Dr. Nguetti Bosso, and Mr. Sawadogo Sibiri of IVRAZ. Dr. Ohm, Dr. Nagy, and Mr. Pardy also attended these meetings.
July 18	— A.M. Meeting with foresters of the Ministry of Environment and Tourism — accompanied by Dr. Ohm, Dr. Nagy, and Mr. Pardy.
July 19	— Visited research farm of the Institut Superieur Polytechnique, Universite de Ouagadougou, to observe living fence and tree establishment research being conducted by Ministry of Environment and Tourism — accompanied by Dr. Ohm, Dr. Nagy, and Mr. Pardy.
July 20	— Spent the day at FSU/SAFGRAD office visiting with staff, reading and writing.
July 22-22	— Saturday and Sunday
July 23	— Visited FSU/SAFGRAD research plots at Poedogo — meeting in P.M. with Dr. Peter Matlon, Ag Economist with ICRISAT.
July 24	— Visited FSU/SAFGRAD research plots at Nedogo.
July 25	— All day monthly meeting with FSU/SAFGRAD field staff.
July 26	— Visited FSU/SAFGRAD research plots at Bangasse.

July 27	—	A.M. Meeting with Dr. Emerson Melaven, USAID Director and Dr. Roger Bloom, PSU/SAFGRAD Project Director — accompanied by Dr. Berb Ohm. P.M. Visited the National Soils Laboratory of the Ministry of Rural Development
July 28 - 29	—	(Saturday & Sunday) Prepared rough draft of final report
July 30 —	—	Left Ouagadougou airport at 1:05 P.M.
July 31	—	Arrived in Lisbon, Portugal at 12:15 P.M.
August 3	—	Left Lisbon at 11:15 A.M. Arrived in W. Lafayette, Ind.

CONSTRAINTS AND RESEARCH NEEDS FOR LIVESTOCK PRODUCTION IN UPPER VOLTA

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INTRODUCTION

Upper Volta suffers from a very low level of food production and overpopulation. However, the number of people/sq. km. is only a small fraction of that of a country such as India. Thus, the basic problem in Upper Volta is not the pressure of the population on the land but the extremely low level of land and labor productivity.

Numerous constraints have been identified relative to increasing agricultural production including:

-low and variable rainfall (350 - 1300 mm). The Sahel zone ranges from 250 - 750 mm. with a rainy season from 60 - 120 days while the Sudan zone ranges from 750 - 1300 mm.

-impoverished soils: soils tend to be extremely low in organic matter and fertility.

-literacy rate is extremely low and even now with considerable emphasis on improving the literacy rate, the primary school enrollment rate is only 18% of the primary school age population (USAID FY 84 CP).

-land tenure policy (uncertainty of land ownership and/or assignment).

-some of the most fertile land is idle (e.g. fertile, low-land due to river blindness-onchocseriasis).

-former colonial policies as well as policies since independence (August 5, 1960) where low priority has been given to food crops.

The agricultural situation and future prospects for Upper Volta are summarized in the following paragraph from USAID FY 84 CP Economic and Social Data for Upper Volta "Mediocre soils and deforestation in relatively densely populated areas limit the potential for agricultural growth in the center and northern regions of the country. Only in the southwest is there good potential for increasing both yields and area under cultivation. However, rapid population growth is slowing the development process by increasing the investment needed simply to maintain current standards of education, health care, and food availability per capita".

An AID financed agricultural sector assessment completed in 1982 pointed out the severity of three basic constraints to increasing agricultural output: "the lack of improved production technologies for the northern two-thirds of the country, the shortage of trained manpower, and the lack of funds for operating costs".

LIVESTOCK PRODUCTION

Ms. Chantal Zoungrana of the Ministry of Rural Development indicated that livestock are extremely important with respect to the economy of Upper Volta and account for 10% of the gross national product. She reported the animal and poultry populations to be:

Cattle	- 3,100,000
Goats and Sheep	- 5,000,000
Pigs*	- 200,000
Donkeys	- 220,000
Horses	- 80,000
Camels	- 8,000
Poultry	-15,000,000

*This small number reflects the high Muslim population.

She also reported the following percentages of animals and poultry sold annually by the owners:

Cattle	11%
Goats and Sheep	30%
Pigs	50%
Poultry	90%

These percentages are slightly lower than the averages reported for the Sahel which are 15% for cattle, 32% for sheep and 40% for goats (Breman & DeWit).

The major constraints to livestock production in Upper Volta is the very low yield of crops, and for 8 to 9 months of the year, very low quality forage. Consequently, animal production is low as a result of malnutrition (McDowell) which causes high mortality of young animals, low growth rates, very low milk production, and reproductive problems. In addition, other constraints such as land tenure and marketing of livestock need special attention if livestock production is to be increased.

FORAGE PRODUCTION AND QUALITY

In general, there is an inverse relationship between forage production and quality (protein) as one goes from the more arid northern portion of Upper Volta to the more humid southern portion. Forage dry matter production ranges from less than 1,000 kg/ha in the north to possibly 4,000 to 5,000 kg/ha in the south. According to Breman and DeWit, the potential dry matter production for these areas assuming adequate moisture and no soil mineral deficiencies is 55,000 kg/ha.

The quality of forage produced in northern Upper Volta is much superior and maybe as high as 18-20% protein with 60-70% digestibility while in the south with greater rainfall and severe N deficiency, the protein content may be only 3-5% with a digestibility of approximately 40%. These values will vary considerably depending upon such factors as local rainfall, species, stage of growth of plants, and soil fertility.

Forage quality is determined largely by the availability of water relative to that of N and possibly P or other mineral nutrients (Breman and DeWit). Young grasses, predominately annual grasses especially in northern Upper Volta, with adequate soil N will contain 18-20% protein but as growth continues the protein level decreases with maturity to about 12%. When N is limiting, as is usually the case, the protein concentration rapidly declines to 3-6%. In order to keep livestock in reasonably good condition, the forage should contain at least 7% protein and for growth and milk production it should be considerably higher.

Thus, it is apparent that the quality of forage may be deficient for a major portion of the year where the growing season is limited by rainfall to only 2 to 4 months. In addition, livestock cannot compensate for poor quality by consuming greater quantities! In fact, with low quality forage, the activity of the rumen is decreased resulting in reduced intake.

In livestock farming, animal production is determined by the quantity and quality of forage available throughout the year. Forage quantity and quality are probably sufficient for only a couple of months in northern Upper Volta (i.e. July & August) and then the

quality and quantity decline although lack of water for the livestock often causes the herders to migrate south before all the forage is utilized. In general, it should be stressed that forage quality in the north (lower rainfall) is considerably higher than in the south where higher rainfall and increased growth rapidly deplete the soil N. Consequently, animal performance in the south is lower despite the greater availability of forage because of the poorer quality forage as well as the utilization of extremely poor quality crop residues (e.g. millet & sorghum) during the dry season.

SOIL AND WATER CONSTRAINTS

Although lack of moisture appears to be the obvious reason for low forage production, the very low soil productivity associated with soil fertility level and organic matter content may be the major limiting factor (Breman and DeWit). Although this soil deterioration process has been going on for centuries, it is just now being recognized because of the increased demand for food as a result of the human population pressure. Breman and DeWit concluded from a research project on Sahelian pastures that "failure to appreciate the effects of low soil fertility as well as low rainfall on pasture production has resulted in underestimation of the productivity of the nomadic and seminomadic livestock farming systems and overestimation of the possibilities for increasing production by better management and by modernization."

The farming systems employed in Upper Volta for centuries have been very exhaustive for the soil since nearly all, or all of the plant material produced including roots, is removed from the land and

no fertilizer is returned to the soil. The vegetative portion of plants, not the seeds, contain the major portion of the minerals. The soil properties for the topsoil of a soil from Upper Volta compared to some major groups of agricultural soils from the other parts of the world are shown in Table I (personal communication with Dr. Peter Matlon, ICRISAT). It will be noted that the soil from Upper Volta is lowest in nearly every category including an organic matter content of only 0.17%. How representative this soil is of Upper Volta is not known.

	Soil Texture			Org. Matter (%)	pH Water	Cation Exchange Capacity (me/100g soil)	Exchangeable Cations		
	Sand (%)	Silt (%)	Clay (%)				Ca	Mg	K
							(me/100g soil)		
Black Clay Soils (Vertisol, India)	22.3	16.5	61.1	1.03	7.6	57.6	47.3	8.5	0.6
Red Soils (Alfisol, India)	64.5	6.0	29.6	0.46	6.7	10.0	6.7	1.5	0.7
Tsjernozem Soils (Mollisol, Roemenia)	—	—	39.5	2.6	7.1	33.9	22.4	6.6	0.6
Alluvial Soils (Sea Clay) (Inceptisol, Holland)	—	—	48.9	3.0	7.4	18.5	15.1	2.0	1.2
Upper Volta Sahel Djibo Area (Alfisols-Bush Field)	93.6	3.9	2.6	0.17	5.7	2.0	0.01	0.06	0.12
North Sudanian Yako Area (Alfisols-Bush Field)	70.2	21.7	8.2	0.95	6.6	6.3	1.80	0.40	0.25
South Sudanian Boromo Area (Alfisols-Bush Field)	65.6	28.4	5.9	0.96	6.5	4.7	0.9	0.25	0.13
Boromo Area (Alfisols-Household Field)	59.3	30.7	10.1	1.07	7.4	5.7	2.0	0.45	0.45

Nitrogen and phosphorus are the most limiting elements. In fact, Breman and DeWit concluded that the low availability of N and K is a more serious problem than low rainfall. Pichot et. al. reported that potassium and micronutrient deficiencies are readily induced with intensified continuous cropping.

Although many people do not realize it, grazing animals also deplete the soil of minerals since meat and milk contain minerals and large quantities of minerals are lost in urine and feces which are deposited around watering places and camps. Thus, the fertility of grassland soils is gradually reduced if the minerals are not replaced as fertilizer or additional manure. These soil-mining practices have been going on for centuries along with excessive soil erosion due to intensive cropping and overgrazing. Consequently, much of the original topsoil has been eroded away frequently exposing hardpans and parent material. The low organic matter content of the remaining "topsoil" (see Table I) results in poor soil structure and compaction which cause low permeability of water and consequently excessive runoff during heavy rains. Rainfall intensities in the semi-arid tropics are 2 to 4 times greater than in temperate climates with loss of up to 60 percent of rainfall through run-off (Matlon). In addition, the low organic matter causes the soils to be more droughty since organic matter acts as a sponge to hold water as well as to provide and hold minerals. Soils from the Sahel have been found to hold only 1/2 to 1/4 as much available water as comparable semi-arid soils in India (Matlon). When considering the above factors, it is not surprising to learn that ruminant livestock production is very low because of extremely low yielding and often poor quality forages.

Simpson concludes from data presented for semi-arid areas of Subsahara Africa that "the essential message is indisputable..only minimal progress has been made in increasing productivity of ruminant livestock, and growth in output is derived from expanded herd numbers". Thus the soil problems associated with low fertility and low water holding capacity must be resolved if grain and livestock production are to be improved in Upper Volta.

CONCLUSIONS

Based on the observations of my present brief visit to Upper Volta, I would suggest that emphasis be focused on the following:

1. Identify mineral nutrient deficiencies for plant and animal production through soil and plant analyses. This will provide a basis for determining fertilizer requirements for various crops as well as mineral supplementation of livestock.

2. Identify and develop economical methods of eliminating mineral deficiencies.

3. Develop cropping and cultural practices to increase soil organic matter and to improve plant water use efficiency through reduced runoff and soil erosion. Consideration should be given to the possibility of constructing small farm ponds or wells for supplementary irrigation and watering of livestock.

4. Maximize legume production in order to:

   a. minimize the need for N fertilizer

   b. provide high protein grain for human consumption

   c. provide protein rich crop residue for ruminants

5. Develop a 12 months forage program to meet the nutritional requirements of various classes of livestock, including donkeys, and thus eliminate animal health and reproductive problems associated with malnutrition. This will require a laboratory for forage analysis of crude protein and *in vitro* digestibility.

6. Weed, insect, and disease control.

7. Development of improved cereal and forage crop varieties as soil, water, and management constraints are alleviated.

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