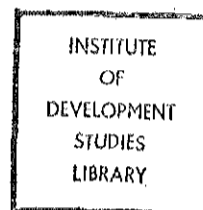


POLICY ALTERNATIVES FOR LIVESTOCK DEVELOPMENT IN MONGOLIA (PALD)

A Research and Training Project



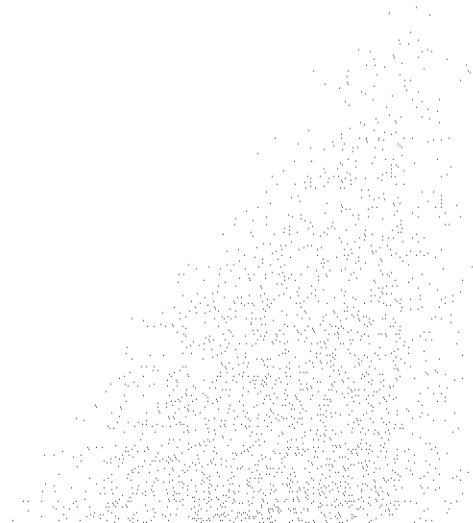
Working Paper No. 4

**Policy Options for Improving
Fodder Supply in the Transition
to a Market Economy**

Dr. S. Jigjidsuren

Senior Researcher
Research Institute of Animal Husbandry

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Glossary of Mongolian terms

<u>aimag</u>	-	province
<u>negdel</u>	-	agricultural (livestock) cooperative
<u>otor</u>	-	rapid moving of animals between pasture areas to put on weight in summer
<u>somon</u>	-	administrative district
<u>suur</u>	-	herders camp(s), the basic unit of production
<u>xot ail</u>	-	traditional unit of social and economic organisation at local level

Plant species names

sorboo- <u>Calamagrostis adans</u>	Söd- <u>Sanguisorba</u>
ulaantolgoi- <u>Agrostis</u>	Hiag- <u>Agropyron</u>
ulalj- <u>Cerex</u>	Hoshuu budaa- <u>Avena</u>
tsargas- <u>Medicago</u>	Erdeneshish- <u>Zea mays</u>
ölöngö- <u>Elymus</u>	Bandui- <u>Pisum</u>
Sogoobor- <u>Bromus inermis</u>	Shar buurtsag- <u>Glucine</u>
Sudan övs- <u>Sorghum sudanense</u>	Raps- <u>Brassica napus</u>
arbai- <u>Hordium</u>	Höh taria- <u>Seeale</u>
Hoshoon- <u>Melilotus</u>	Ulaanbuudai- <u>Triticum</u>
Sugar beet- <u>Beta vulgaris</u>	

**POLICY OPTIONS FOR IMPROVING FODDER SUPPLY IN THE
TRANSITION TO A MARKET ECONOMY**

PRESENT SITUATION OF FODDER SUPPLY

An increase in livestock production is directly linked to fodder supply; in nomadic livestock husbandry, this is always dependent on ecological and climatic conditions.

The period 1935-1955 was favourable for skilled Mongolian herdsman and genetically resistant indigenous livestock. During that period the total loss of animals each year was approximately 1.65 million. But in the period between 1955-1970, when collectivization and a rapid urbanization of the rural people took place, the vital links between the herders and livestock were broken down. Total losses during this period were 21.6 million or 1.76 million each year.

In the last 20 years, a large investment has been made in livestock production. This was aimed at increasing productivity by more cross-breeding of animals, establishing big agro-industrial complexes and improving fodder and water supply. Losses during this period were estimated at 21.6 million totally or 1.08 million annually.

The black monkey year 1944-1945, brought extraordinarily high snowfall and unusually low temperatures which caused the loss of some 9 million livestock. Conditions were just as bad in 1986-1987, but only 0.8 million head of animals were lost because of improved fodder production and distribution. This shows that improved fodder production can prevent animal losses during unusual natural conditions.

On average about 1 million fodder units were prepared annually during 1986-1990. But in 1991 this fell to 543 thousand units. In other words fodder production in the country decreased to the level of 1970-1971. For example in 1991 total production of cereals decreased by 50%, green fodder by 70%, straw prepared for animal feeding by 86%, hand made (prepared) feed by 50%, silage by 47%, manufactured fodder by 37% and hay by 27% in comparison with production between 1986-1990.

The reasons for this decreased fodder production are the following:

- (i) The importance of fodder production, especially for the pastoral livestock industry, has not been generally accepted.
- (ii) Administrative and technological support for fodder production through incentives for the production of high quality fodder has been insufficient.
- (iii) Rapidly increasing costs of agriculture inputs led to a stagnant situation in fodder production in the country.
- (iv) The machinery and other techniques used at 25 state fodder enterprises and 143 small scale fodder units are obsolete, and need urgent renovation and reconstruction.
- (v) Fodder production using high cost irrigated fields has proved to be economically unprofitable.

During 1986-1990 the share of hay in total animal fodder was 52%, silage and green fodder 23%, and concentrates 19%. In 1991, this had changed to 71%, 8%, 19% respectively, that is to say, the amount of green and succulent fodder had decreased very substantially. Hay is estimated to be the cheapest source of livestock fodder in Mongolia. Because of inadequate attention to improved and rotational use, the productivity and yield of natural hay fields has decreased slightly.

During 1986-1990, the amount of fodder estimated per head of animals (in terms of sheep units) was about 20 kg or 40% of total feed supplements, but in 1991 this was reduced to 22%. Many existing national fodder reserve stations and points have broken down and the amount of fodder stored in the national emergency reserve has been reduced by 58%.

As a result of all these trends, livestock diseases have increased and many intensive livestock production complexes have a severe shortage of fodder.

The main policy of the government in the transition period to a market economy should be directed to keeping production of animal feed at least at the level of 1986-1990. This is a key issue for effective control over livestock production.

POLICY OPTIONS FOR IMPROVING FODDER SUPPLY

There have been changes in the national economy related to the transition from a command economy to a market-oriented system. State and cooperative enterprises have been privatised in outline and different types of ownership have appeared.

All these changes suggest that government policy on livestock fodder supply should be reviewed. The recently established companies, cooperatives and individual private operations are mostly interested in profitable husbandry based on traditional livestock herding skills and experience.

In order to improve the fodder supply the main objectives of government policy for the next few years should be to:

- (i) Create local fodder reserves to prevent or minimise pastoral livestock losses in case of sudden climatic events;
- (ii) Provide reliable fodder supplies to large complexes such as dairy, poultry and pig farms which are of great importance in the food supply of cities and towns.

1. Fodder requirements in short and medium term

The measures taken by the government concerning grazing management, pasture land tenure, privatisation of cooperative and state owned animals, and the reduction of the number of animals at suur (basic production unit) level provide an opportunity to recreate traditional livestock herding practices. This has some advantages, as follows:

- (i) It will improve the structure of the herds through increased care for young animals and culling of those animals which are not able to overcome harsh winter and spring conditions.

- (ii) It will allow better organization of otor (rapid migration of animals between pastures) as soon as possible early in the spring and will allow animals to graze freely and put on weight.
- (iii) It will encourage herders to prepare different types of feed using all the local resources available.
- (iv) It will encourage timely separation of exhausted and weak animals from the herds and allow them to be given good supplementary feed.
- (v) It will encourage herders to prepare fodder themselves and more readily use fodder distributed by the state.

We have calculated the amount of fodder needed to securely maintain the breeding stock, surviving young animals, and some draught animals, in the pastoral livestock herds. The total amount of fodder required has been calculated in Table 1 using the feed rations developed by the research institutions.

Basic annual fodder requirement for the total livestock population, including poultry and pigs, is estimated at 1400.8 thousand tonnes of fodder units. This is 2.6 times more than the total fodder produced in 1991.

The fodder requirement of the livestock sector will increase to 1600.0 thousand tonnes in 1995 and to 1765.3 thousand tonnes in 2000. Such an increase would protect livestock from sudden climatic disorders and would substantially reduce animal losses. At the same time improved fodder supply will contribute to increasing livestock productivity. About 55-58% of the total fodder will be required to cover supplementary feeding of local indigenous livestock.

One aim of this policy is to establish state fodder reserves for emergency distribution in 13 aimags and cities, with a storage capacity of 200-250 thousand tonnes of hay and 100-150 thousand tonnes of mixed feed (concentrate, briquettes and mixed). At the same time there is a need to improve the machinery and technology of feed storage establishments in order to reduce transport costs and to lengthen storage life with minimal damage and losses.

Table 1: Basic fodder requirements

Kind of animals	Year	Total live-stock number ('000)	Share and number of fed animals in herd %	number	Amount of supplementary feed needed per head/year	Total fodder requirement ('000 tonnes/fodder units)
C a m e l	1991	445.2	10	44.5	0.3	13.3
	1995	546.6	10	54.7	0.3	16.4
	2000	676.6	10	67.7	0.3	20.3
H o r s e	1991	2259.3	5	113.0	0.3	33.9
	1995	2426.4	5	121.0	0.3	36.3
	2000	2500.0	5	125.0	0.3	37.5
M c o a n t g o l l e	1991	2676.0	30	802.8	0.35	281.0
	1995	3173.3	30	952.0	0.35	333.2
	2000	4100.0	30	1230.0	0.35	430.5
M s h o n e g o p l	1991	13522.2	50	6761.1	0.05	338.0
	1995	15058.1	50	7529.0	0.05	376.5
	2000	16443.0	50	8221.0	0.05	411.0
M g o o n a g t o l	1991	4849.1	55	2667.0	0.04	106.7
	1995	5450.0	55	2997.5	0.04	119.9
	2000	5736.0	55	3154.8	0.04	126.2
Pure bred and crossed cattle	1991	146.0	100	146.0	3.0	438.0
	1995	150.0	100	150.0	3.0	450.0
	2000	150.0	100	150.0	3.0	450.0
Pure bred and crossed sheep	1991	1197.3	100	1197.3	0.09	108.0
	1995	1200.0	100	1200.0	0.09	108.0
	2000	1300.0	100	1300.0	0.09	117.0
Pure bred and crossed goat	1991	398.1	100	398.1	0.06	23.9
	1995	400.0	100	400.0	0.06	24.0
	2000	400.0	100	400.0	0.06	24.0
P I G	1991		100			17.0
	1995		100			84.5
	2000		100			103.5
C h i e c n	1991	162.0	100	162.0		16.0
	1995	304.0	100	304.0		30.0
	2000	470.0	100	470.0		47.3
Total	1991					1400.8
	1995					1600.0
	2000					1767.3

2. The condition of natural pastures and ways to improve their management

Natural pastures of 12 million hectares are a main fodder resource of the country. There are strong customs and institutions regulating pasture utilization, passed from generation to generation. But since the 1950s the customary rights of individuals to own restricted pasture areas, especially those around their winter shelters, have to some degree disappeared. As a result, the yield of the main pastures has decreased by 20-25%. In addition, about 45 million hectares of pasture land have been abandoned and are not used, more than 1 million hectares has been desertified by moving sand, 123 thousand hectares have been damaged by roads and 181.7 thousand hectares of fertile virgin land have been degraded by cultivation; 4.2 million hectares of pasture in the steppe zone have been damaged by rodents. Only about 60% of the total pasture area is supplied with water, as figure 1 shows.

Taking this situation into account, the government should, in the right sequence, take the following measures in order to improve pasture and preserve its productivity:

- (i) Seasonal pasture land tenure arrangements for xot ail and private households should be completed in 1992-1995.
- (ii) Policies to encourage rural people to return to their traditional Family areas, to give them tenure and to improve the pastures should be enacted. For this purpose, a number of measures should be taken, including rebuilding old hand-operated wells, allocating small rivers and springs, and digging new hand-operated bore holes and water ponds. Also, some incentives such as interest free loans, supplying electricity, communications facilities, and abundant consumption and production goods.
- (iii) Inter-aimag and inter-somon grazing reserves should be created, and flexible and free access allowed to them both on a regular basis and especially during times of hardship. This kind of measure should be combined with a reasonable grazing fee on each animal in the herd.
- (iv) A national programme named "Rehabilitation of the Mongolian Gobi", sponsored by the government, should be developed with the aim of rehabilitating degraded pastures in the steppe and Gobi zones by using a wide range of techniques, including preventing sand movement and increasing local fodder production through rainwater harvesting. For successful realization of this project international assistance and guidance will be essential.
- (v) Some (at first, 4 or 5) permanent stations to produce seed and introduce promising pasture plants should be established in the dry steppe and Gobi regions. Specialists to carry out this work should be trained and important techniques should be imported.
- (vi) The area of cultivated pasture for dairy cattle, poultry and pigs should be increased by encouraging the potentials of companies, private households and individuals.
- (vii) A system of arbitration on pastoral land tenure should be established through law courts.

FIG. 1
PASTURE SERVED BY WATER

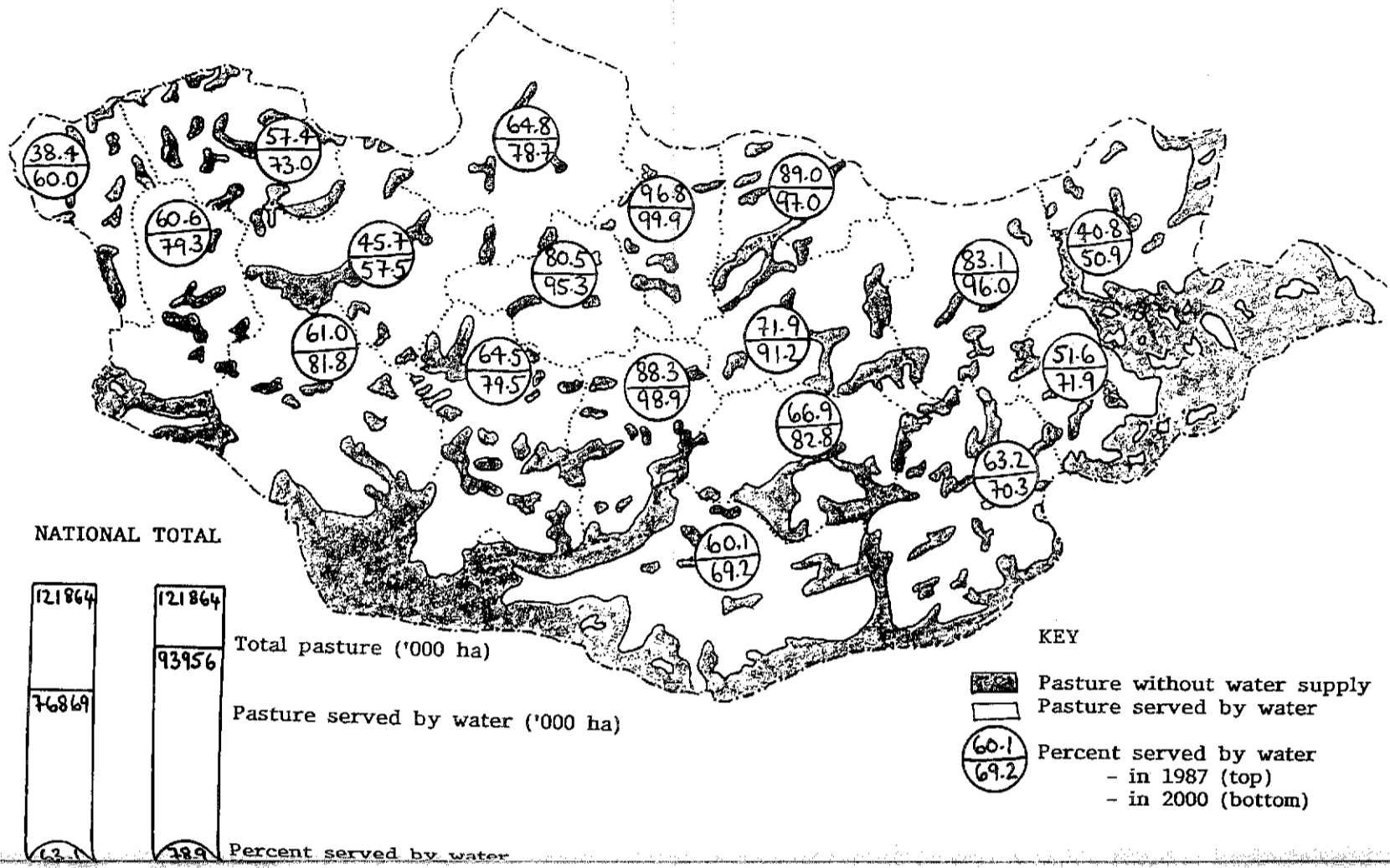
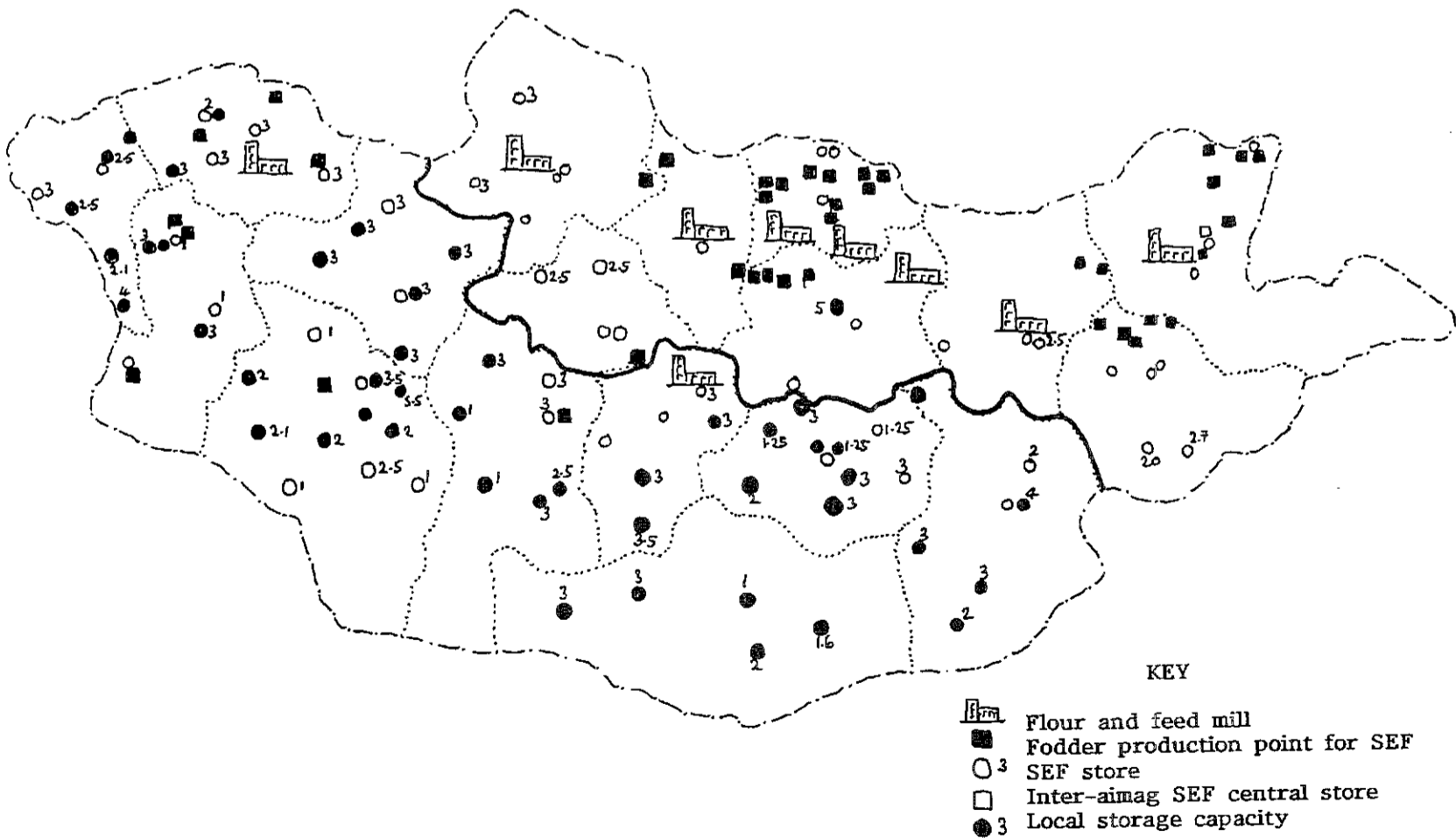


FIG. 2 LOCATION OF FODDER PRODUCTION AND RESERVES FOR STATE EMERGENCY FODDER FUND (SEF)



- (viii) Promotion and advertising should be directed to urban people in Ulaanbaatar, Darkhan, Erdenet and other main towns and villages to encourage them to improve natural pastures and create cultivated pastures in their own interest.
- (ix) A number of activities directed at improving and restoring pastures used for market livestock should be undertaken with the financial assistance of government. It is essential that producers who run private small-scale livestock fattening farms and meat processing units along the trekking roads are allowed free credit, low-cost machinery and other necessary inputs.

3. Meeting basic fodder requirements

The location of present fodder production and reserves for the State Emergency Fodder Fund (SEF) are shown in figure 2. The following measures would ensure that basic future fodder requirements are met.

3.1 Hay

Hay will remain the cheapest source of livestock fodder in the immediate future. It was estimated in 1987-1988 that 1235.4-1246.5 thousand tonnes of hay were harvested. It is planned to increase the amount of hay to 1400 thousand tonnes in 1995 and 1600 thousand tonnes in 2000. In order to achieve this, a combination of institutional and technical changes are needed.

Institutional factors

- (i) Fields where hay is cut for the national reserve should be taken under government control. At the same time all storage and other facilities which are needed should be repaired in the near future and provided with everything necessary to run small-scale production.
- (ii) In order to improve fodder security in the Gobi and western part of the country, the nearest hay fields should be located and research and production activities should be carried out.
- (iii) An incentive system should be devised to encourage companies, cooperations and individual herders to increase pasture yield, enlarge rehabilitated areas and improve the efficiency of pasture use.
- (iv) Local fodder reserves should be created in each aimag and somon with a capacity to supply 10-15% of their total fodder requirements.
- (v) A government fund should be created out of part of the livestock insurance premiums, the fodder distribution fund and local budgets. This fund would be used to implement projects to improve fodder supply in the livestock sector.
- (vi) Increased fodder production in the private sector can be encouraged by organizing local training on pasture improvement and utilization.
- (vii) Each herder or group of herders should be allocated freehold tenure of a limited number of hay-making fields.

- (viii) Mobile mechanized groups run by the local fodder reserve organizations should be established to provide timely services at the request of individuals and companies who need pasture improvement assistance.
- (ix) Cooperatives specialised in agricultural input supply and distribution are needed. There is also an urgent need to organize production of mini machinery for fodder production and to increase imports of such small scale machinery.

Technical factors

In some aimaks like Bayanolgii, Hovd, Ubs, Zavkhan, Bulgan and Uburhangai, where there are pasture and meadow areas suitable for improvement into hay fields, research on ways to do this should be conducted. It has been estimated that these aimags possess about 25 thousand hectares of land suitable for improvement by re-seeding and irrigated fodder production.

Experiments in Hovd show much improved productivity of hay fields structurally improved by subsoil cultivation by disc to 30-35 cm, and planting with Elimus dahuricus; the grass yield of this plant, under irrigation, was on average over 4 years 20-30 centners ('00 kg) per ha. The productivity of the same field was further increased to 50.1-64.5 centner/hectare (c/ha) when fertilizers $N_{120}P_{60}K_{60}$ (in terms of active substances) were used.

Hay fields dominated by some fodder species (Calamagrostis adans, Agrostis and some kinds of herbs), irrigated for 7 days and fertilized by $N_{120}P_{60}N_{60}$, have an average yield of 35 c/ha of hay. This demonstrates that there is much potential in the Altai Mountain and Great Lakes areas for increased preparation of hay using simple improvement techniques (irrigation, fertilization, re-seeding etc).

Analysis shows that, given the very high transport cost of fodder distribution from the central areas to the western aimags, it would be more economical to create 20-25 thousand hectares of improved hay-making fields (with a yield higher by 15-20 c/ha than present harvests). In this case the amount of locally prepared hay would reach 30-50 thousand tonnes annually.

As regards Bayanhongor, South Gobi and Gobi-altai aimags, where hay harvesting is not at all possible, the distance fodder has to be transported should be reduced as much as possible. For this purpose, priority should be given to improving hay and pasture areas in Arhangai and Bulgan aimags. Research expeditions have located 6.6 thousand hectares of hay pastures suitable for simple improvement in the southern somons of Arhangai aimag and 3.4 thousand hectares in Bulgan.

Research results suggest that tussock swamp meadows improved by re-seeding with Medicago-Elymis-Bromus inermis and manuring with $N_{120}P_{60}K_{60}$ give an average hay yield of 46.6-52.6 c/ha. The yield of non-irrigated meadows of the same type is 16-24 c/ha.

Table 2. Areas suitable for irrigated fodder production in western aimags

<u>Aimags and somon</u>	<u>Name of place</u>	<u>Total area (thousand ha)</u>
1. <u>Ubs aimag</u>		
- Hovdo	Hovd golyn hondii	0.2
- Omnogobi Gashuun		0.3
- Bokhmuren	Bokhmuren golyn adag	2.0
- Tes	Tesiin golyn hondii	6.0
	Sebhuul	1.0
- Ulaan tolgoi	Systemyn adag	0.2
- Turgen	Heer mort	1.0
Sub-total		<u>10.7</u>
2. <u>Bayanolgii aimag</u>		
- Tsengel	Shar nuur	0.4
- Sagsai	Turgen bituu	0.4
- Ulaanhus	Tsagaan denj. Sogoot	0.5
- Bugat	Ikh bulan	0.2
- Altan tsogts	Ulaan khargana	1.0
- Bayannuur	Ikh tsagaan, shar aral	2.0
- Nogoonnuur	Khar dakhir, deed araa	3.0
Sub-total		<u>7.6</u>
3. <u>Hovd aimag</u>		
- Myangad	Shar bandi	1.0
- Buyant	Shar guu	3.1
- Bulgan	Shar tolgoin ust	1.0
- Zereg	Ekh aral	0.3
- Chandman	Bor aral	0.3
- Mankhan	Zereg gol	0.2
- Hovd	Byaruuntain gol	0.1
- Erdeneburen	Hovd golyn sav	1.0
Sub-total		<u>7.0</u>
Total		25.3

The hay yield of herb meadows in forest steppe and high mountain areas, fertilized by up to 30 tonnes/ha of locally available manure and irrigated three times with 300 m³ per hectares, increases from 5-6 c/ha to 34.2 c/ha. It should be pointed out that more than 400 thousand hectares of hay fields can be improved by using all of these methods. In that case, the average yield of hay increases by 7-8 c/ha.

The soil of the whole territory of Mongolia is deficient in nitrogen. In the present stage of agricultural development we are not able to supply the minimum amount of nitrogenous fertilizer required. This is because fertilizer plants have not been built in the country, and import costs have increased rapidly.

In order to increase the hay harvest by 320 thousand tonnes, 40,000 tonnes of potash, 60,000 tonnes of superphosphate and 80,000 tonnes of N-Dure fertilizers need to be supplied annually. Generally the demand for different kinds of fertilizer in agriculture is very high. As a first priority, the Government and other institutions must establish medium and small fertilizer plants in the near future. Fertilizer needs cannot be met by high cost imports.

3.2 Fodder grains

Fodder grains are the main component of manufactured concentrates and mixed feed for pigs and poultry.

Demand for fodder grains will be 190,900 tonnes in 1995 and 245,800 tonnes in 2000, as table 3 shows.

Table 3. Demand for fodder grains ('000 tonnes)

	1995	2000
1. Dairy cattle	22.0	23.3
2. Poultry	20.9	32.0
3. Pigs	40.0	51.3
4. As a component of manufactured concentrates	108.0	139.2
Total	190.9	245.8

The requirement for feed grains will be as follows: wheat, 35,000 tonnes in 1995 and 40,000 tonnes in 2000; barley and oats, 156,000 tonnes in 1995 and 205,800 tonnes in 2000. About 80% of these feed grains will be used in the production of concentrates and mixed fodder by fodder enterprises.

To produce this amount of fodder grains the sown area will have to be increased to 115,500 hectares in 1995 and 136,300 hectares in 2000.

Table 4. Requirements for mixed fodder and concentrates ('000 tonnes)

	1995	2000
1. Supplementary feeding of ruminant livestock	200.0	250.0
2. Poultry	32.6	41.7
3. Pig	14.0	21.8
Total	246.6	313.5

Annual demand for balanced concentrates for dairy and fattening cattle, poultry and pigs is 46,600 tonnes in 1995 and 101,600 tonnes in 2000. As regards mixed fodder, the figures are 200,000 tonnes in 1995 and 213,300 tonnes in 2000.

For successful achievement of these targets, all the existing fodder enterprises will have to be rehabilitated and 40-50 medium and small fodder and mixed feed enterprises will have to be established.

3.3 Silage and hay (grass) silage

Silage is used as a succulent feed in dairy farms. The main change in silage making should focus on reducing sunflower and replacing it with grass silage. The main raw materials for grass silage making in central areas will be a mixture of barley-rye-oat (Hordium-Avena-Pisum) and barley-oat-rape seed (Hordium-Avena-Brassica napus).

In the warmer areas of the Great Lakes, corn and sudan grass (Zea mays and Sorghum sudanense) should be planted on a large scale.

About 50-55 % of the total fodder needed for dairy cattle will be supplied by grass silage. The yield of silage crops is at present extremely low. Research should be carried out to choose high yielding silage crop varieties and to improve the quality of silage (storage and minimizing losses of highly digestible compounds).

3.4 Green fodder

We should strongly reject the risky approach of growing barley, oats and other fodder grains. At present it mostly produces high cost green straw, following the well-known maxim "if lucky, harvest grains; if not, green straw".

Mainly green fodder should be used as harvested green feed for dairy cattle and fattening animals in late summer. Alfalfa, rape seed and beans should be planted to provide granulated high protein feed.

In order to supply dairy cattle with high quality green fodder in late summer (September-October), sown areas under cut fodder crops should be increased to 9,9000 hectares in 1995 and 10,500 hectares in 2000.

Government intervention in this field should include incentives for using Medicago and Melilotus in rotational cultivation of fodder grasses. In our opinion, this is a key way to increase fodder production and improve soil fertility in irrigated areas.

Widespread cultivation of alfalfa is the main way to increase cultivated fodder production, and will make it possible to minimize protein deficiency in high yielding wool sheep. The basic policy should be to increase cultivated areas under fodder production to 7,000-8,000 hectares in 1995 and 150,000 hectares in 2000. Also, more attention should be paid to increasing irrigated fodder production in areas of the Western aimags which possess accessible water resources, and to re-equipping existing irrigation systems.

3.5 Other fodder resources

Mongolia has abundant resources which could contribute to increased fodder production. One possibility is hand-made feed. There are about 300 types of hand-made feed. There should be a campaign by the government: "Each family (not ail) is a fodder producer for the four seasons of the year".

Effective choice and adoption of modern techniques for processing by-products of animal and agriculture origin would be of great importance. About 300,000-400,000 tonnes of oil-seed and mill by-products could be processed and used as animal feed.

4. Conclusion

The conclusion, as table 5 shows, is that successful application of all the measures discussed above would meet 61% of basic fodder requirements by 1995, and 64% by 2000.

To achieve this, large investments should be made, mostly to improve hay and pasture grounds, to rehabilitate promising areas for grazing and fodder cultivate to increase irrigated fodder production and to supply necessary inputs.

Measures should be taken to strengthen the material and technical capacity of research institutions, to increase research projects, and to improve the quality of specialists. Research and production activities, including investigation of the geneplasm of fodder plants adapted to Central Asian ecological conditions, production of certified high quality seeds, and broad experimenting with introduction of promising varieties of exotic fodder crops, should be intensified.

All these measures will lead to an increase of fodder production without decreasing the sown area.

Table 5. Meeting fodder demand (thous. tonn/fod. unit)

Kind of fodder	1995			2000	
	Amount of fodder required	Production capacity	Cover %	Amount of fodder required	Production capacity
1.Hay	1037.0	540.0	52.1	1059.0	630.0
2.Silage and grass silage	160.0	63.5	39.7	176.5	80.0
3.Green fodder	88.3	88.3	100.0	88.3	88.3
4.Mixed and concentrates	161.2	161.2	100.0	283.3	170.0
5.Fodder grain	73.5	73.5	100.0	114.7	80.0
6.Straw	48.0	30.0	62.5	53.0	53.0
7.Other	<u>32.0</u>	<u>26.0</u>	<u>81.3</u>	<u>35.2</u>	<u>30.0</u>
TOTAL	1600.0	982.5	61.4	1765.0	1131.3

Table 3. Yield of fodder crops (centner/ha)

Sectors	Fodder grains			Green fodder		Silage grasses		
	barley	oats	beans	annual	perennial			
State farms	15.3	10.3	8.0	26.3	34.0	156.2		
Cooperative farms	11.9	9.5	6.2	19.9	15.1	109.1		
Hay harvesting, yield								
Zones	1971-1975		1976-1980		1981-1985		1986-1990	
	yield cent/ha	hay harvest ths/t	yield cent/ha	hay ths/t	yield cent/ha	hay ths/t	yield c/ha	hay ths/t
Western	4.8	115.4	7.7	169.4	7.6	195.6	7.4	181.4
Central	6.0	471.8	5.0	621.0	5.6	691.6	5.4	670.4
Eastern	7.1	213.8	5.0	271.8	5.2	322.9	5.1	307.9
Total	6.0	801.0	5.3	1068.2	5.2	1210.0	5.1	1159.7

Table 4. Sown areas under fodder crops
(thous. hectares)

Kind of fodder	1995			2000		
	Total fodder production	Yield	Sown areas	Total fodder production	Yield	Sown areas
Fodder grain	190.9	12.0	159.0	245.8	15.0	164.0
Hay	1400.0	7.5	1867.0	1600.0	8.7	1839.0
Grass silage	103.0	120.0	8.6	120.0	140.0	8.6
Green fodder (absolutely dry matter)	150.0	20.0	75.0	150.0	21.4	70.0
Total			242.6			242.6

Table 5. Total grass silage required for dairy cattle

Age and sex of animals	1991			1995			2000		
	Number	per head 000t	total 000t	number	per head 000t	total 000t	number	per head 000t	total 000t
1. Cows and heifers	19882	3.4	67.6	22036	3.4	74.9	23405	3.6	84.3
2. Two year olds	3423	1.4	4.8	3772	1.4	5.3	4115	1.8	7.4
3. Calves	12817	0.4	5.1	13897	0.4	5.6	15160	0.6	9.1
Total	36099		77.5	39707		85.8	43315		100.8

Table 6. Total hay required by state dairy farms (tonnes)

Age and sex of livestock	1991			1995			2000		
	Number	per head 000t	total 000t	number	per head 000t	total 000t	number	per head 000t	total 000t
1. Dairy cows/heifers	19882	2.0	39.8	22036	2.0	44.1	23405	2.5	58.5
2. Two year olds	3423	1.1	3.8	3772	1.1	4.1	4115	1.6	6.6
3. Calves	12817	0.6	7.7	13897	0.6	8.3	15160	1.0	15.2
Total	36099		51.3	39707		56.5	43315		80.3

Table 7. Concentrates and mixed fodder required by state dairy farms

Age and sex of livestock	1991			1995			2000		
	Number	per head	total 000t	number	per head	total 000t	number	per head	total 000t
1. Cows and heifers	19882	1.4	27.8	22036	1.4	30.9	23405	1.4	32.8
2. Two Year olds	3423	0.4	1.4	3772	0.4	1.5	4115	0.4	1.6
3. Young	12817	0.3	3.8	13897	0.3	4.2	15160	0.3	4.5
Total	36099		33.0	39707		36.6	43315		38.9

Table 8. Pasture areas required by state dairy farms

	1991			1995			2000		
	Number	per head	total ha	number	per head	total ha	number	per head	total ha
1. Cows and heifers	19882	0.5	9941	22036	0.5	11018	23405	0.5	11700

Table 9. Green standing and cut-and-carry fodder required by state dairy farms

	1991			1995			2000		
	Number	per head	total 000t	number	per head	total 000t	number	per head	total 000t
Cow and heifers	19882	0.45	'000h	22036	0.45	'000ha	23405	0.45	'000h
45x40=0,45 4000		0.35	8946 yield 35c/ha			9916.0			10532

Note:

In this system, cows and heifers consume 40kg, 2 year old females 30kg, yearlings and calves 20kg of green fodder daily. The yield is calculated as 40kg/ha. Duration of this feeding is 40-45 days, starting on 21 August to 1 October. When animals graze cultivated pasture, 0.5 ha of non-irrigated pasture and 0.3ha of irrigated pasture is required per animal, from 1 June - 20 August, totally 80 days.

Table 10. Root-crops required by state dairy farms

	1991			1995			2000		
	Number	per head	total 000t	number	per head	total 000t	number	per head	total 000t
and heifers	19882	0.240	'000t	22036	0.3	'000t	23405	0.5	'000t
			4.8			6.6			9.4
		yield per hectare	171c			180c			200c
			281ha			366.7ha			470ha

Table 11. Total fodder concentrate requirement by pig farms ('000t fodder units)

	1991	2000
Grain	46.5	56.9
Concentrates	11.0	13.5
Green fodder	8.5	10.9
Grass meal	2.5	3.1
Bone meal	2.5	3.1
Fodder yeast	3.4	4.1
Dried milk	3.4	4.1
al	84.5	103.4

Table 12. Total fodder requirement by poultry
('000t fodder units)

	1991		2000
1. Wheat	8.2	15.6	24.0
2. Barley	1.3	2.2	3.4
3. Cornflake	1.0	1.7	2.7
4. Bean	0.7	1.4	2.1
5. Soy	1.5	2.8	4.3
6. Alfalfa meal	0.4	0.6	0.9
7. Bone meal	0.8	1.4	2.1
8. Fodder yeast	0.8	1.4	0.9
9. Bran	0.4	0.6	0.9

Table 13. Total demand for feed grains ('000t)

Kind of crops	1995	2000
Sub-standard wheat	35.0	40.0
Barley	100.0	131.0
Oats	45.9	60.8
Corn	1.7	2.6
Bean	3.0	7.0
Soy	2.8	4.3
Total	190.9	245.8

Table 14. Total sown area required for fodder cereal

Kind of crops	1995			2000		
	Amount of fodder cereals required ('000 t)	Average yield (cent/ha)	Total sown area ('000 ha)	Amount of fodder cereals required ('000 t)	Average yield (cent/ha)	Total sown area ('000ha)
Sub-standard wheat	35.0	-	-	40.0	-	-
Barley	100.0	16.0	62.5	131.1	18.0	72.8
Oats	45.9	10.3	44.6	60.8	12.0	50.7
Bean	3.0	9.0	3.3	7.0	10.0	7.0
Corn	1.7	40.0	0.4	2.6	40.0	0.6
Soy	2.8	6.0	4.7	4.3	8.0	5.4
Total	190.9		115.5	245.8		136.5