Technical Report No. 103

BOTANICAL SPECIES OF PLANTS EATEN AND INTAKE OF CATTLE AND SHEEP GRAZING SHORTGRASS PRAIRIE

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ABSTRACT

Esophageal fistulated heifers were used to obtain samples of the diets of light and heavy use pastures. Esophageal fistulated heifers and sheep were used to collect dietary samples on the herbivore diet pastures. Grasses made up a major portion of the diet in 1970. They were relatively more important than in 1969. This was probably due to a reduced availability of forbs because of 1970 precipitation. Blue grama (*Bouteloua gracilis*) was the most important grass eaten. Other grasses of importance were western wheatgrass (*Agropyron smithii*), red threeawn (*Aristida longiseta*) and needle-and-thread (*Stipa comata*). The sedge, *Carex heliophila*, was also important. Forbs were less prominant in the diets of cattle on the light use pasture in 1970 than in 1969. Environmental limitations due to precipitation may have reduced the availability of forbs to cattle. Scarlet globemallow (*Sphaeralcea coccinea*) was again the most important forb and was apparently a preferred forb. Many other forbs were noticed in the diet, but were not of continued individual importance. Shrubs were a very minor component of the diet. Dietary crude protein was adequate throughout the summer. Dry matter digestibility declined through the season and was lower in July and August on the heavy use pasture. Dry matter intake and digestible energy intake increased seasonally. The intake per animal was lower in the heavy use pasture. Winter samples were collected in December of 1969. These indicate that winter diets include a much greater proportion of the half shrub fringed sagewort (*Artemisia frigida*) in the light use treatment, whereas shrubby plants on the heavy use pasture were not nearly as important. The thistle (*Cirsium undulatum*) was evidently eaten in unusual quantity in the heavy use pasture at the time winter samples were obtained.

INTRODUCTION

The major means for entry of humans into the food chain of grasslands is through the domestic herbivores. Conversion of grazing lands into meat for humans which is highly nutritious is an essential function of domestic herbivores. Through this conversion of fibrous materials which are not utilizable by humans, grasslands become an important entry for humans into the grasslands ecosystem. The purpose of the large herbivore studies is to determine their impact on the ecosystem so that the grassland resource can be managed efficiently without environmental degradation to the long-term benefit of man.

PROCEDURE

Animals

The project during 1970 had two phases. In phase I, esophageal fistulae were established in yearling heifers. These heifers, four to each treatment, were randomly allotted to either the light use pasture or the heavy use pasture. They were included with the normal heifers, who acted as grazers on the two pastures. After a month adjustment period, the heifers were used for collection of esophageal dietary samples and for total fecal collections.

Esophageal collections were obtained twice each week during the months of June, July, and August. A 24-hour fecal collection with fecal bags was obtained once each week. A winter dietary sample was obtained during December.

Diet samples were obtained both in the morning and in the afternoon. The best success with sampling was after the once-a-day late morning watering period which was established because of the project relating water intake to

dry matter intake on the pastures. The animals were weighed biweekly and watered once daily.

In phase II, two heifers and four yearling wether sheep with esophageal fistulae were used to sample the herbivore study pastures. These pastures were also the site of dietary studies with antelope and bison. This phase of the large herbivore studies was designed to establish the dietary relationships in the context of grasslands. Extrapolation to the larger study area will be possible since cattle diet studies were common to both areas.

Sample Processing

Dietary samples were put into air tight plastic bags and frozen. For analyses, the bags were thawed, mixed, and divided into two portions. One portion was used for the preparation of microscopic slides according to the procedure of R. M. Hansen. These slides were sent to Fort Collins where they were analyzed for botanical composition by microscopic characteristics (R. M. Hansen 1969).

The second portion was dried in a forced air oven at 60°C, ground through a 40 mesh screen, and analyzed for ash, nitrogen, gross energy and acid detergent fiber, cellulose, and lignin (Van Soest 1968). *In vitro* dry matter digestibility was determined (Tilley and Terry 1963) and *in vivo* digestion estimated by a regression equation established from known *in vivo* samples (Rice, personal communication).

Fecal samples were weighed, sampled, and analyzed for botanical species, ash, moisture, nitrogen, and gross energy as above.

RESULTS

Animal Management Phase I

It was theoretically possible to collect a total of 32 samples per treatment per month. However, sampling failure occurred due to a number of reasons so that 10-14 total samples were usable for analyses during each month. Reasons for failure to sample were:

(i) Contamination with regurgitated material.

(ii) Animal refusal to eat.

(iii) Inadequate amount of sample.

(iv) Failure or damage of equipment.

(v) Animals not in condition for sampling.

Heifers were used instead of steers in 1970 due to animal management problems when steers and heifers were mixed together during the previous year. It is more difficult to collect fecal samples from heifers since their anatomy makes separation of urine and feces a problem. In order to separate feces and urine excretions, a deflector designed for use with restrained animals was modified and fit to the grazing heifers used in this study. This deflector was successful. It would also be possible to collect urine quantitatively with this deflector if a suitable container could be developed to hold the urine. Urinary collections were attempted with the use of bags constructed of truck tire inner tubing. Loses of urine were common with this bag due to tearing or separation of the collection hose and bag, or leakage of urine from the bag when the animals lay down.

Botanical Composition of the Diet

The botanical species identified in the esophageal samples are listed in Table 1. There were fewer species found in 1970 than in 1969. This was

Table 1. Weight percent of plants in esophageal samples of heifers grazing the light and heavy use pastures in 1970.

Scientific Name	Grazing Treatment	June		July		August	
		Mean	No.	Mean	No.	Mean	No.
Agropyron smithii	Heavy	7.2 (2.8) [a/]	14	4.8 (1.7)	14	6.3 (2.8)	3
	Light	2.3 (0.3)	10	6.3 (0.7)	10	3.0 (3.0)	2
Aristida longiseta	Heavy	8.7 (3.0)	14	8.7 (2.9)	14	7.3 (2.1)	3
	Light	1.7 (0.3)	10	4.4 (0.6)	10	3.8 (0.9)	2
Bouteloua gracilis	Heavy	42.4 (4.3)	14	41.2 (6.9)	14	33.1 (11.7)	3
	Light	29.7 (3.2)	10	44.6 (1.8)	10	24.4 (5.2)	2
Carex sp.	Heavy	17.2 (2.3)	14	13.6 (5.9)	14	9.0 (6.2)	3
	Light	9.6 (0.7)	10	13.5 (0.7)	10	22.8 (21.8)	2
Chrysopsis villosa	Heavy	0.4 (0.37)	14	19.1 (7.2)	14	0.4 (0.4)	3
	Light	0 (0)	10	2.2 (0.5)	10	17.6 (7.0)	2
Festuca octoflora	Heavy	3.8 (1.9)	14	.1 (0.5)	14	.2 (0.2)	3
	Light	2.7 (0.5)	10	.4 (0.1)	10	0	2
Sphaeralcea coccinea	Heavy	3.8 (0.7)	14	7.9 (2.0)	14	0 0	3
	Light	2.1 (0.3)	10	12.0 (1.2)	10	2.5 (1.4)	2

Table 1. (Continued)

Scientific Name	Grazing Treatment	June		July		August	
		Mean	No.	Mean	No.	Mean	No.
Stipa comata	Heavy	4.5 (4.5)	14	0.47 (0.3)	14	0	3
	Light	40.9 (3.7)	10	1.0 (0.3)	10	0	2
Total grasses	Heavy	87.0 (2.1)	14	65.3 (6.9)	14	57.3 (13.2)	3
	Light	87.4 (1.5)	10	72.1 (1.6)	10	56.4 (25.5)	2
Total forbs	Heavy	12.4 (2.0)	14	32.1 (8.6)	14	42.7 (13.2)	3
	Light	11.5 (1.5)	10	26.7 (1.7)	10	43.2 (25.9)	2

a/ Numbers in parentheses are standard errors.

probably due to the difference in precipitation during the two years. The amount of rain during 1970 was much less during the growing season, and many of the annual forbs were not established or grew in very small amounts so that they were effectively eliminated from dietary consideration by the animal. The measurement of availability of different plants in the pastures is essential before preference for plant species can be established.

The weight percent of various plant taxa in the diet during the summer are also shown in Table 1. Grasses made up a major portion of the diet in both light and heavy treatments. The amount of grass declined through the summer. There was not a large difference in grass percent in light and heavy pastures, although there tended to be less grass in the diet of the heifers in the heavy use pasture in July than in the light use pasture. All precipitation in 1970 was lower, and the response in terms of forb growth and availability for grazing appeared to be much less.

The major grasses making up the diet were blue grama (*Bouteloua gracilis*), western wheatgrass (*Agropyron smithii*), needle-and-thread (*Stipa comata*), red threeawn (*Aristida longiseta*), and six weeks fescue (*Festuca octoflora*). The proportion of the grass-like sun sedge (*Carex heliophila*), was also important. Buffalograss (*Buchloe dactyloides*) was present in most samples but was never observed in an amount exceeding 3% of the total diet. Blue grama was by far the most important grass. It made up an average of 38.9% of the diet in the heavy use pasture and 29.6% of the diet in the light use pasture. Blue grama was greatest during July, followed by August and June. The amount of blue grama in the diet was considerably more than that found in 1969.

The second most important grass was red threeawn. The grass was especially important in the heavy use pasture. It made up an average of

8.2% overall in the heavy use pasture and 3.3% in the light use pasture. Red threeawn was important only during the month of June of 1969 in the heavy use pasture.

Western wheatgrass was eaten in moderate amounts throughout the summer in both heavy and light use pastures (average 6.1% in heavy pastures and 3.9% in light pastures. More was eaten in the heavy use pasture in June and August and less in July.

Needle-and-thread grass was of considerable importance in the light use pasture in June (40.9%). During the balance of the season in the heavy use pasture, it was a minor component of the diet. Apparently, this species was palatable only for a limited period during the early growing season and was actively sought out early, then neglected, either due to a lack of availability or to a change in desirability to cattle. This grass was of minor importance during 1969.

The other grass which was found in appreciable amounts was six weeks fescue. It appeared at a level of about 3% of the diet during June and was found in trace amounts during July and August. The growth characteristics of this forage, rapid development to maturity, apparently affect its availability and palatability to grazing cattle. It was not important in the 1969 grazing study.

The weight percent of sun sedge was relatively high in both treatments. It occurred in a fairly constant amount in both treatments (heavy 13.3% and light 15.3%). This forage was apparently eaten when available and was fairly palatable throughout the season. In 1969, the amount of this plant declined as the season progressed.

The weight percent of total forbs in both light and heavy treatments increased as the summer grazing season progressed. The amount of forbs in

the diet was not different according to treatment. The amount of forbs grazed throughout the grazing season was considerably less in the light grazed treatment than in 1969; this difference did not vary appreciably in the heavy treatment. This relationship indicates that certain forbs are preferred by cattle and that they will select them if given the opportunity. Forbs in 1970 were suppressed by the environment, thereby reducing the availability in the light grazed treatment, whereas in the heavy grazed treatment the incidence of favored forbs was reduced due to grazing pressure and not due to the effects of environmental differences, especially moisture availability.

The importance of scarlet globemallow (*Sphaeralcea coccinea*) to the total forbs noted in 1969 was again reinforced in 1970. This forb is apparently sought actively by cattle and is usually used more heavily in July than in June or August. The same pattern of use was exhibited during both 1969 and 1970. The 1970 levels of usage were much lower than in 1969, and this was probably due to moisture limitation on its availability. When available, it appears to be sought out by cattle.

The only other forb of importance during 1970 was hairy goldaster (*Chrysopsis villosa*). This forb was important in July in the heavy use pasture and in August in the light use pasture. Many other forbs were noticed in the esophageal samples (Table 1), but these were of minor or momentary importance to the diets of cattle. The decrease observed in the occurrence of forbs in the diet of cattle in 1970 as compared to 1969 was probably due to a reduced availability of this type of plant as a result of a smaller amount of precipitation.

Dietary Nutrient Content

The crude protein content of esophageal samples was adequate in all cases for the cattle in this study (Table 2). It averaged about 11% for the grazing season with protein values slightly lower on the heavy vs. light grazing treatment and slightly lower in August than in June or July. The protein values were slightly lower for June and July than in 1969 but were as high in August. The limitation of these pastures to productivity of heifers would not be protein at these levels in the diet.

The gross energy values of esophageal samples did not vary appreciably according to season or intensity of use (Table 2). Similar gross energy values were obtained for the dry fecal material (Table 3). Analyses for crude fiber, cellulose, and lignin are not yet available.

Utilization and Intake

Dry matter digestibility was lower for the July and August samples in the heavy use pasture. In contrast, they remained at a relatively high level throughout the summer on the light use pasture (Table 2). This illustrates the ability of cattle to select a digestible diet when the opportunity for selection is not limited by grazing pressure. The digestibility of the diet in June was similar for both treatments. On the heavy use pasture, the cattle selected diets as digestible as those on the light use pasture when grazing pressure and advancing maturity had not limited selection opportunity.

The daily digestible energy intakes of the esophageal heifers indicate a response to the grazing treatment and to season (Table 4). The animals on the heavy use pasture ate more digestible energy than those on the light use pasture in June. However, in July and August the digestible energy intake

Table 2. Chemical analysis of esophageal fistula samples.

Analysis	Grazing Treatment	June		July		August	
		Mean	No.	Mean	No.	Mean	No.
Crude protein	Heavy	11.6 (1.2)[b/]	11[a/]	10.7 (1.3)	19	9.9 (1.8)	9
	Light	11.8 (1.9)	3	11.7 (1.6)	9	10.1 (2.4)	5
Gross energy (kcal/gm D.M.)	Heavy	3.8 (0.3)	19	3.8 (0.5)	24	3.9 (0.3)	12
	Light	3.8 (0.3)	4	4.1 (0.3)	16	4.0 (0.2)	9
Percent dry matter	Heavy	64.8 (7.4)		58.4 (9.8)		52.2 (7.1)	
	Light	63.5 (6.3)		64.6 (5.3)		61.2 (4.9)	

[a/] Refers to number of samples analyzed to date.
[b/] Numbers in parentheses are standard errors.

Table 3. Gross energy of fecal samples (kcal/gm D. M.).

	June	July	August
Heavy	3.4	3.7	3.7
Light	3.5	3.9	3.8

Table 4. Daily intake.

Daily Intake	Grazing Treatment	June	July	August
Digestible energy (kcal/head)	Heavy	7832.4	5740.5	7485.3
	Light	6320.9	10,497.0	11,537.8
Dry matter (kg/225 kg animal)	Heavy	2.8 (1.4)[a/]	2.8 (0.7)	3.3 (0.7)
	Light	2.5 (0.5)	4.0 (0.2)	4.6 (0.6)

[a/] Numbers in parentheses are standard errors.

of the light use cattle was greater than those on the heavy use treatment. Intake on the heavy use pasture was especially limited in July. The intake was higher in August, probably in response to late July and early August precipitation. Cattle on the light use pastures increased their intake seasonally. The same relationships were noted in the dry matter intakes of the esophageal cattle (Table 4). The intakes of the animals were lower than expected for these types of cattle. The weight changes observed in these cattle reflect the effect of the low intakes. Animals on the light use pasture were able to maintain a small gain throughout the grazing season, whereas those on the heavy use treatment lost weight in June and July and made a small gain in August (Table 5). It should be recalled that these animals were fistulated and handled intensively throughout the summer and could not be expected to respond to the same degree as normal animals with respect to weight gain and intake. However, normal animals would be expected to follow the same pattern of response to the fistulates. Intact animals on the same grazing treatments were able to make a moderate gain on the heavy use pasture and a reasonably good gain on the light use pasture (Dyck and Bement 1971). It is proposed that future intake estimations will be accomplished with intact heifers.

Winter Samples

Dietary samples were collected on the heavy and light use pastures in December of 1969. The number of species present in the winter diets of cattle was less than that observed in the summer (Table 6). During the winter, many species were not present on the pastures or were unacceptable to the animals. Three grasses, one half-shrub, two forbs, and one sedge

Table 5. Weight changes (kg) for heifers (summer 1970).

	Animal No.	June	July	August
Heavy	78	+0.5	+3.1	+3.2
	88	-21.8	+7.3	+15.9
	73	-3.2	-7.7	+8.2
	98	-2.3	-4.1	+8.6
Light	31	-2.3	+5.5	+55.0
	27	0	+6.8	+11.3
	10	+18.1	-1.8	+14.1
	684	-5.4	-3.2	+20.5

Table 6. Proportion (% frequency) of selected individual species in esophageal samples (January 1970).

	Heavy	Light
Red threeawn	3.3	3.4
Blue grama	25.5	51.5
Carex sp.	3.3	15.5
Total grassland grasslike plants	32.8	73.9
Fringed sagewort	11.0	21.4
Wavyleaf thistle (*Cirsium undulatum*)	29.3	1.7
Scarlet globemallow	1.4	2.1
Unknown forbs	24.1	0
Total forbs and shrubs	67.2	26.1

were noted in the diets of cattle grazing on the heavy and light use pastures. It is interesting that the same species were consumed in both pastures.

Blue grama was the predominant grass consumed in both pastures. The high incidence of wavyleaf thistle consumed in the heavy use pasture may be overestimated due to sampling techniques. Animals were allowed to graze from 30-45 minutes with collection bags on. If an animal found a thistle plant during the collection time, almost the entire period would be taken in consuming this plant. Also, a 24% incidence of unknown forbs was recorded for the heavy use diets.

Thistle parts were rather coarse and required extended masceration by a Waring blender to obtain parts small enough to spread on slides. Other forbs present may have been subdivided so finely that identification was not possible. Therefore, a large quantity of unidentified forbs was present.

Grasses were much more important in the heavy use pasture diets (Table 6). The cattle on the light use pasture ate mostly grass and the half-shrub, fringed sagewort, whereas the cattle in the heavy use pasture ate equivalent amounts of grasses and forbs and a lesser amount of fringed sagewort. The effects of summer grazing pressure appear to make important limitations on the type of winter diets consumed.

Phase II

A limited sampling with cattle and sheep on the small diet pastures was accomplished in 1970. More extensive sampling was not possible for several reasons:

(i) Priorities for sampling by other herbivore groups.

(ii) Lack of time and labor for more sampling.

(iii) Limitations on use of pastures due to the level of use desired on these areas.

(iv) Maintenance of fistula problems with esophageally fistulated cattle.

There were dietary samples collected during each month of the summer. These samples were prepared for botanical and chemical analyses. These analyses have not been finished at this date.

SUMMARY

Grazing intensity affected the proportion of botanical species eaten, the nitrogen content of the diet, the digestibility of the diet, and the intake of dry matter and digestible energy of cattle. These differences were reflected in lower gain per animal on the heavy use pasture. Heavy grazing limited the ability of cattle to select as high a quality diet, or to eat as much as those on lightly grazed pastures.

The winter samples also indicated that heavy summer grazing influenced opportunity of animals to select a quality diet.

The differences observed in dietary makeup and utilization between the two years studied indicate the influence of environmental differences from year to year on the grazing habits of cattle. It is essential that a study such as this be continued over a period of years and that information on detailed plant production and availability of individual plant species present under varying environments be available for the synthesis effort.

Necessary information for proper synthesis efforts must include production of plants by species, detailed site and vegetation maps, and grazing behavior of cattle as influenced by environment, season, and intensity of use. Further studies should be organized to provide this information.

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APPENDIX I

FIELD DATA

Data on large herbivore diets collected in 1970 at the Pawnee Site in connection with this study is Grassland Biome Data Set A2U601B. A description and listing of the data follow.

Data Description

The data are recorded in small subsets. For each subset a variable or number of fields are read from each of a variable number of slides. Data are then recorded with one header card per subset and a variable number of cards for information on species encountered, with up to nine species per card.

Column	Contents
	Header Card
1-2	Data type (17)
3-4	Site (11-Pawnee)
5-6	Number slides this subset
7-9	Number fields this subset
10-19	Investigator
43-44	Number slides this subset
45-46	Number fields per slide
64	Number data cards following this subset
66-67	Year
68-70	Subset number
71-72	Lab identifier

Species Cards

1-4	Genus/species
5-7	Number of fields in which this species was observed
8-11	Genus/species
12-14	Number of fields in which this species was observed

This scheme is repeated across the card until up to nine species are recorded.

64-72	Same as header card

*** DATA ***

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        1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678
1711 2 40      RICE                                 220                  2 70  1  1
BOGR  6CAHE   3SPCO 11CHNA  2STCO  2AGSM  1SPCR  1PSTE  1                1 70  1  1
CAHE  9CHNA   2KOSC  2BOGR  5SPCO  8AGSM  3SPCR  1CHVI  1STCO  10 70  1  1
1711 2 40      RICE                                 220                  2 70  2  1
AGSM  4CAHE  12ARLO  1BOGR  8SPCO  4GUSA  3                            1 70  2  1
AGSM  4GUSA   5CAHE 12BOGR  7STCO  2                                    0 70  2  1
1711 2 40      RICE                                 220                  2 70  3  1
BOGR 16CAHE   7SPCO  4STCO  1AGSM  1                                    1 70  3  1
BOGR 13SPCO   1CAHE  8STCO  1AGSM  2KOSC  1GUSA  1                      0 70  3  1
1711 2 40      RICE                                 220                  2 70  4  1
OECO  7SPCO  11STCO  2PSTE  4GUSA  3BOGR  2CAHE  1                      1 70  4  1
CAHE  2SPCO  11PSTE  5OECO  3GUSA  1BOGR  3AGSM  2STCO  1               0 70  4  1
1711 2 40      RICE                                 220                  2 70  5  1
OECO  2BOGR  15CAHE  2ARLO  1SPCO  1                                    1 70  5  1
BOGR 15SPCO   1OECO  1SPCR  2AGSM  1ARLO  2CAHE  2                      0 70  5  1
1711 2 40      RICE                                 220                  2 70  6  1
  9BOGR  10CAHE  4EVNU  4CHVI  1                                        1 70  6  1
  GR  12AGSM   5CAHE  3EVNU  3STCO  1                                   0 70  6  1
1711 2 40      RICE                                 220                  2 70  7  1
BOGR 15SPCO   3STCO  1SPCR  1OECO  2CAHE  4                            1 70  7  1
SPCO  4BOGR  14STCO  2CAHE  1ARLO  2                                    0 70  7  1
1711 2 40      RICE                                 220                  2 70  8  1
AGSM  8BOGR  14SPCO  3STCO  2KOSC  2ARLO  2PSTE  1CAHE  1               1 70  8  1
BOGR 12SPCO   4CAHE  7AGSM  3                                          0 70  8  1
1711 2 40      RICE                                 220                  2 70  9  1
BOGR 13STCO   3CAHE  7ARLO  2AGSM  2SPCO  1                            1 70  9  1
BOGR 14STCO   1SPCO  3CAHE  4AGSM  1                                    0 70  9  1
1711 2 40      RICE                                 220                  2 70 10  1
BOGR 19ARLO   2CAHE  4STCO  1SPCR  2                                    1 70 10  1
BOGR 17ARLO   5CAHE  8SPCR  2                                          0 70 10  1
1711 2 40      RICE                                 220                  2 70 11  1
CAHE  4EVNU  16OECO  2BOGR  2SPCO  2                                    1 70 11  1
EVNU 14CAHE   6OECO  4BOGR  4SPCO  1                                    0 70 11  1
1711 2 40      RICE                                 220                  2 70 12  1
BOGR 13EREF   1SPCO  6EVNU  2CAHE  2ARLO  1OECO  2                      1 70 12  1
BOGR 16CAHE   3EVNU  3OECO  1SPCO  4AGSM  1                            0 70 12  1
1711 2 40      RICE                                 220                  2 70 13  1
BOGR 17CAHE   1STCO  1AGSM  1                                          1 70 13  1
BOGR 18SPCO   1AGSM  1SPCR  1                                          0 70 13  1
1711 2 40      RICE                                 220                  2 70 14  1
BOGR 16ARLO   3AGSM  1CAHE  1OECO  1SPCO  1                            1 70 14  1
AGSM  4BOGR  15ARLO  4OECO  2CAHE  3SPCO  1                            0 70 14  1
  11 2 40      RICE                                 220                  2 70 15  1
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BOGF 14ARLO  5AGSM  1CAHE  2                                    1 70 15 1
 PCR  3BOGR 16ARLO  5AGSM  2CAHE  1SPCO  1                      0 70 15 1
1711 2 40     RICE                          220                 2 70 16 1
SPCO  1BOGR 16ARLO  4AGSM  1                                    1 70 16 1
STCO  1BOGR 15ARLO  4CAHE  1                                    0 70 16 1
1711 2 40     RICE                          220                 2 70 17 1
BOGR 17AGSM  1ARLO  5CAHE  1                                    1 70 17 1
BOGR 15CAHE  4AGSM  3ARLO  3                                    0 70 17 1
1711 2 40     RICE                          220                 2 70 18 1
STCO  2CAHE  2BOGR 17ARLO  1SPCO  2AGSM  1                      1 70 18 1
AGSM  2BOGR 16KOSC  1CAHE  2ARLO  1                             0 70 18 1
1711 2 40     RICE                          220                 2 70 19 1
AGSM 12BOGR  8ARLO  2CAHE  2                                    2 70 19 1
BOGR 13AGSM  9OECO  1STCO  2SPCO  1ARLO  1                      0 70 19 1
1711 2 40     RICE                          220                 2 70 20 1
ARLO 13SPCO  2BOGR  3LARE  1ASTR  1CHNA  2                      1 70 20 1
CAHE  2BOGR  4ARLO 11CHNA  2SPCO  3LARE  2                      0 70 20 1
1711 2 40     RICE                          220                 2 70 21 1
BOGR 19AGSM  2SPCO  2ARLO  1STCO  1                            1 70 21 1
BOGR 16SPCO  3ARLO  3AGSM  1OECO  1STCO  1                      0 70 21 1
1711 2 40     RICE                          220                 2 70 22 1
BOGR 14AGSM  6ARFR  2CAHE  1ARLO  4                            1 70 22 1
CAHE  2AGSM  2BOGR 17ARFR  1OECO  1ARLO  1                      0 70 22 1
1711 2 40     RICE                          220                 2 70 23 1
BOGR  7CAHE  4ERDI  7AGSM  2ARFR  2ARLO  2SPCO  1              1 70 23 1
ARLO  3CHVI  6BOGR  8CAHE  5ERDI  1PSTE  1                      0 70 23 1
 .1 2 40     RICE                          220                 2 70 24 1
 GSM  2ARLO  4BOGR 12CAHE  2SPCR  3SPCO  2                      1 70 24 1
BOGR 14ARLO  5CAHE  2AGSM  4SPCO  2                            0 70 24 1
1711 2 40     RICE                          220                 2 70 25 1
BOGR 16CAHE  4AGSM  7ARLO  3ERDI  2                            1 70 25 1
BOGR 13AGSM 10CAHE  7ERDI  1                                    0 70 25 1
1711 2 40     RICE                          220                 2 70 26 1
BOGR 16ARLO  6CAHE  2SPCR  2AGSM  1                            1 70 26 1
CAHE  3BOGR 15AGSM  1ARLO  1                                    0 70 26 1
1711 2 40     RICE                          220                 2 70 27 1
SPCO  1BOGR 14AGSM  8ARFR  1OECO  3SPCR  2                      1 70 27 1
CAHE  5SPCR  2BOGR  8AGSM  4OECO  1                            0 70 27 1
1711 2 40     RICE                          220                 2 70 28 1
BOGR 19CAHE  5AGSM 30ECO  1ARLO  1ASTR  1SPCO  1SPCR  1        1 70 28 1
AGSM  5STCO  4BOGR 15LIPU  1OECO  2SPCO  1                      0 70 28 1
1711 2 40     RICE                          220                 2 70 29 1
BOGR 18AGSM  2CAHE  2LIPU  1SPCR  1OECO  1                      1 70 29 1
BOGR 18ARLO  1SPCR  4AGSM  4CAHE  1                            0 70 29 1
1711 2 40     RICE                          220                 2 70 30 1
BOGR 16SPCR  3SPCO  1AGSM  2CAHE  1                            1 70 30 1
BOGR 16STCO  1AGSM  3CAHE  1ARLO  1SPCO  1                      0 70 30 1
1711 2 40     RICE                          220                 2 70 31 1
BOGR 14ARLO  4SPCO  1CAHE  5AGSM  3SPCR  4                      1 70 31 1
BOGR 17ARLO  3AGSM 20ECO  1STCO  1                            0 70 31 1
1711 2 40     RICE                          220                 2 70 32 1
BOGR 15AGSM  2SPCR  2CAHE  1OECO  1SPCO  1STCO  1              1 70 32 1
 OGR 19STCO  1SPCR  3                                          0 70 32 1
1711 2 40     RICE                          220                 2 70 33 1
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BOGR 13AGSM  5ARLO  5SPCR  1STCO  2CAHE  1                    1 70 33 1
CAHE  5BOGR 14STCO  2ARLO  2AGSM  2SPCR  1                    0 70 33 1
1711 2 40     RICE                          220                2 70 34 1
AGSM  9BOGR 12CAHE  3                                          1 70 34 1
AGSM  5BOGR 15LIPU  2CAHE  20ECO  1ARLO  1STCO  1             0 70 34 1
1711 2 40     RICE                          220                2 70 35 1
BOGR 11SPCR  2ARLO  7STCO  2AGSM  4                           1 70 35 1
SPCR  1BOGR 11ARLO  7AGSM  3STCO  2CHVI  1                    0 70 35 1
1711 2 40     RICE                          220                2 70 36 1
ARLO  5BOGR 14AGSM  3CAHE  4                                  1 70 36 1
BOGR 13ARLO  4AGSM  1CAHE  50ECO  2                           0 70 36 1
1711 2 40     RICE                          220                2 70 37 1
ARFR  1BOGR 18CAHE  2SPCO  1                                  1 70 37 1
BOGR 17SPCO 10ECO  1AGSM  1CAHE  1                            0 70 37 1
1711 2 40     RICE                          220                2 70 38 1
BOGR 14ARLO  2SPCR  1SPCO  1AGSM  1CAHE  1                    1 70 38 1
AGSM  1BOGR 17CAHE  3SPCO  2ARLO  1                           0 70 38 1
1711 2 40     RICE                          220                2 70 39 1
AGSM  5BOGR 16CAHE  2ATCA  1STCO  10ECO  1SPCO  1             1 70 39 1
AGSM  8BOGR 130ECO  1STCO  1SPCO  1CAHE  2                    0 70 39 1
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