EXTRACTION OF PROTEINS FROM GRASSES*+

by

F.H. Shah, M.H. Sedi and B.A. Nadeem¹

Summary. Ten grasses were evaluated of their nutritive value. Percentage of total and extractable proteins was maximum in the first regrowth harvested at one month interval. It then decreased with an increase in age of the crop. Maceration of the grasses with water after pulping increased the extractability of protein upto 183%. The yield of the extractable protein/per hectare/per year was upto 502 kg.

Introduction. Tropical grasses are photosynthetically very efficient and are a great potential for protein extraction (Hutton, 1970; Loomis, et al 1971; Ludlow and Wilson, 1968). However, extractability of protein from grasses was reported to be low due to their high fibre contents and lesser capacity to take up moisture on maceration (Arkcoll, 1971). Arkcoll and Festenstein (1971) obtained 1670 kg/ha of protein from cocksfoot. Protein preparation from young and mature leaves was reported by Arkcoll (1971) and Davies et al (1952). Extractability of protein from leaves was studied by Byers (1961) and from leaves abundantly available in Pakistan by Nazir and Shah (1966, 1968). Gore et al (1974) extracted protein from hybrid Napier Grass.

The present study deals with changes in the proximate composition and extractability of protein from various grasses with seasonal changes and maturity.

Material and Methods. The grasses were propagated in lines of plots measuring 10 x 3 metres. All the grasses, except Napier Millet hybrid, were grown from seeds. The distance between each line being 45 cm. Root stocks or Napier Millet hybrid were planted at a distance of 20 cm.

Seed rates for millet, sudan grass, maize and sorghum were 12, 20, 50 and 50 kg/ hectare respectively. The plots were watered soon after sowing and then after every 2 weeks or when needed. Weeding was done at suitable intervals and the use of insecticides, pesticides, fertilizer or manure was totally avoided. Harvesting was done in the morning using steel sickle and the herbage yield was calculated at the spot.

Grasses were analysed for their ash, fibre, lipid and protein contents by A.O.A.C. (1970). For dry matter determination 20-30 gm. of the pulped leaves were dried at 100-110° in an oven for 8-10 hours.

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-Pakistan Council of Scientific and Industrial Research Laboratories, Ferozepur Road, Lahore.

Sr.	Species MOST	Source of Seeds or Root Stocks	Date of Growing
1.	Maize (Neelum)	Agriculture Research Farm, Yusufwala, Sahiwal.	26-5-1972
2.	Maize (Syn. 200)	do—do—do—do	—do—
3.	Maize (Sy. 545)	d with as greenob coline cras.	_do_
4.	Millet (B-18)	Agriculture Research Farm, Lyallpur.	7-6-1972
5.	Millet (Ex-Borneu)	—do—	do
6.	Millet (Giant)	estensien (1911_obmed 1670 kgfm	—do—
7. (ATEL)	Napier Millet Hybrid	Forest Range Management Nursery, Lahore.	8-3-1972
8.	Napier Millet Hybrid	—do—	8-2-1974
9.	Sorghum (D.G. Pearl).	Agriculture Research Farm, Lyallpur.	29-8-1972
10.	Sorghum (J.S. 263)	All the grant object Mariet Ma	—do—
11.	Sudan Grass (Sorghum)	_do_ (% io same	12-5-1972

Protein Extraction. Three successive extractions of proteins from grasses were made using IBP Pulper and the belt press by the method of Nazir and Shah (1966). Loss of the juice was minimized by processing 2 kg. of the grass before actually extracting the juice from 5 kg of the crop. Proteinous and non-proteinous N was calculated as Trichloroacetic acid (TCA)-insoluble and TCA-soluble N respectively.

Results and Discussion. Yield of Crop. Table I shows that the herbage yield depended on species, harvesting interval, climatic conditions and age of the grasses. Neelum maize gave maximum yield (6.46 tons/hectare) when harvested after 45 days of sowing. The crude protein, lipid and fibre contents were higher in "Neelum" than the other two maize varieties but ash and total extractable N was lesser than the other two. The maximum extractability (47.58%) was observed in case of Maize (Syn. 200). This

appears to be due to higher moisture content (89.41%) of the crop. The yield of millet (B-18) in the first cut, was 10.84 tons/hectare, which decreased to 7.37, 3.40 and 1.57 in the Ist, 2nd and 3rd regrowths harvested at 30 days intervals. Dry matter and lipid contents showed increase in the regrowths, whereas ash, crude fibre and protein contents increased till 2nd regrowth, after which these decreased. A similar pattern was observed in case of millet (Ex-Borneu) and Giant millet.

Out of the two Sorghum varieties J.S. 263 gave higher herbage yield, and higher protein, lipid, ash and fibre contents than D.G. Pearl. Percentage extractability in case of J.S. 263 was also higher because of its higher moisture content (83.75%) than that of the other variety (77.63%). The herbage yield of Sudan Grass was maximum 22.55 tons/ha) in the 1st regrowth of 60 days but % extractability of protein was the minimum (3 00%) as compared with the crops harvested at 30 days interval. The difference in extractability of Napier Millet hybrid from 31.57 to 88.55% appeared to be due to variation in the moisture contents. The herbage yield and lipid contents increased while protein contents decreased with an increase in the age of the crop. Appearance of new leaves in case of Sudan Grass and Napier Millet hybrid resulted in an increase in the protein contents (Table-I) which was observed in 64 days and 81 days old crops. Although an improvement in herbage yield was noticed during monsoon it was species varient as is evident from the Table-I. The yield of Millet (Ex-Borneu) was more in August than that in July, 1972 while the herbage yield of other two varieties decreased in August. The herbage yield of Sudan Grass was maximum in the month of November. Our findings are in agreement with the observations of Vartha et al (1973), who reported changes in herbage yield and extractability by irrigation and with change in season.

Extractability. Table-I shows that the extractability of proteins from Sudan grass and Maize (Syn. 200) was 3.00 and 72.27% respectively. The difference seems to be due to variation in the moisture contents of the plants. The extractability improved with an increase in moisture contents of the plants. Our results agree with the findings of Dev. et al (1974) and Deshmukh et al (1974) that the extractability was more in monsoon (i.e. due to high moisture content) than that of summer. Dev. et.al. (1974) and Gore et al (1974) on their trial on Hybrid Napier grass had noted an improvement in the extractability during monsoon season. Vartha et al (1973) had recorded an increase in extractable protein from lucern by irrigation. It is also evident from Table-I that the extractability is not totally dependent upon the amount of total N. These findings are in agreement with the results of Byers (1961) and Byers and Sturrock (1965).

Extractability Vs Age. The effect of age on the extractability of protein is shown in Table-I. It is evident that with an increase in the age of Napier Millet hybrid, the extractability of both PN and NPN decreased from 36.91 to 16.70% and 23.91 to 14.87% respectively in 30 and 50 days regrowths during 1973 and from 57.56 to 32.73% and 30.99 to 30.29% in 30 and 60 days regrowths during 1974. In case of Sudan grass the decrease in extractability of both PN and NPN was from 5.31 to 0.78% and 5.99 to 2.22% respectively. Byers and Sturrock (1965) made a similar observation while extracting protein from different crops. The decrease in extractability is also due to an increase in D.M. % with

an increase in the age of the crop. These findings agree with the observations of many workers (Deshmukh et al 1974; Dev et al 1974; Nazir and Shah, 1966; Vartha, et al 1973).

Extractability Vs Water Contents. Table II depicts the effect of maceration of the crop with water on the extractability of protein. It is evident that 12.5 to 182.9% more protein could be extracted when moisture content of the grasses increased by the addition of water. In case of Giant Millet the % protein extracted was increased from 59.13 to 94.92%, which was maximum among the grasses reported. However, Oelshlegel et al (1969) had reported that Sur (1967) was successful to extract upto 96% of the protein from the water-hyacinth by lowering the pH of the juice to 3.5 before heating.

Yield of Protein. Yield of crude and extractable protein of 7 grasses is depicted in Table III. The amount of extractable protein varied from 42.7 to 502.9 kg./ha/yr. in Maize (Syn. 545) and Millet (Giant) respectively. The low extractability could be due to the fact that the grasses were propagated without the use of any fertilizer or manure. Gore et al (1974) with liberal application of fertilizers, have reported 2000 kg/ha/yr. of extractable protein from Hybrid Napier grass in India.

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TABLE I

Proximate Analysis and Extractability of Protein from Grasses

Protein Protein Protein Protein Protein Protein Protein Protein Protein Cut. Cut. Age in Yield DryWt. Ash (Nx60) % % % Nx60 % % Nx60 % % Nx60 Nx60 % % Nx60 Nx60 % % Nx60	Species Date of Age in Yield Dry Wt. Ash New Only Cont. Date of Age in Yield Dry Wt. Ash New Only Cont. Date of Age in Yield Dry Wt. Ash New Only Cont. Date of Age in Yield Dry Wt. Ash New Only Day Da							Crude				% Extra	ctability
Decree. Cut. Age. Tron/lat. 2, 7, 11 (Nx6.0) Lph. 2, 7, 11 (Nx6.0) Lph. 2, 12 (Nx6.0) Lph	Pecus. Out. Age. In Trial 1, 87, 87, 10, 10, 10, 10, 10, 10, 10, 10, 10, 10		Date of	A can in	Viold	D-:: U/+		Protein	Pini I	Libro	(Total of		ractions)
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do- Aug, 1972 30 reg. 8.67 15.33 7.31 9.21 2.18 26.12 26.71 9.64 36.76 do- Sept, 1972 30 reg. 3.83 14.15 9.47 10.02 3.95 27.00 37.76 10.21 47. do- July, 1972 40 old, 21.07 12.25 10.81 11.84 3.14 23.91 32.86 10.20 66.51 b. Aug, 1972 30 reg. 6.30 12.47 9.19 9.23 27.00 37.76 10.90 61. b. Sept, 1972 30 reg. 6.30 12.47 9.19 9.23 2.19 22.18 39.06 61.11 37.85 10.90 34. 39.06 61.11 37.35 39.06 61.11 37.35 39.06 61.11 37.35 39.06 61.11 37.35 39.06 61.11 37.35 39.06 61.11 37.35 39.06 41.31 37.25 39.06 41.37 39.06	do- Aug. 1972 30 reg. 8.67 15.33 7.31 9.21 2.18 26.12 26.71 9.64 36. do. do- Oct, 1972 30 reg. 3.83 14.15 9.47 10.02 3.95 27.00 37.76 10.21 47.10 40.21 47.11 47.25 10.81 11.84 3.14 23.91 23.91 47.61 10.21 47.61 6.32 27.00 84.56 19.66 65.10 96.61 97.23 20.08 47.61 10.22 10.81 11.84 23.91 23.91 23.91 47.61 10.22 10.81 11.84 23.91 23.91 47.83 10.90 97.32 10.90 47.83 10.90 97.22 10.90 97.23 11.83 13.23 13.83 13.23 13.83 13.23 13.83 13.23 13.83 13.23 13.83 13.23 13.83 13.23 13.83 13.93 13.83 13.93 13.83 13.93 13.83 13.93 13.	t (Ex-Borneu)	_	45 old.	7.83		9.24	8.75	2.54		25.04	16.02	
do- Sept. 1972 30 reg. 3.83 14.15 9.47 10.02 3.95 27.00 37.76 10.21 47.20 do- Oct. 1972 30 reg. 1.17 21.56 9.28 7.72 2.21 20.58 45.65 19.66 65.51 iant) July, 1972 40 old. 21.07 12.25 1.88 1.89 23.91 32.38 29.09 46.65 b. Sept. 1972 30 reg. 6.30 12.47 9.19 9.23 2.60 27.25 45.58 19.66 65.51 J.S. dot. 1972 30 reg. 15.25 10.80 1.57 26.72 45.58 19.69 15.75 19.50 45.11 57.00 37.76 19.50 36.71 37.50 19.23 37.50 18.50 8.30 10.80 1.57 26.72 45.58 19.56 19.51 47.61 47.61 47.61 47.61 47.61 47.61 47.61 47.61 47.62 47.61 47.62<	do- Sept. 1972 30 reg. 3.83 14.15 9.47 10.02 3.95 27.00 37.76 10.21 47.72 do- Oct. 1972 30 reg. 1.17 21.55 9.28 7.72 2.21 20.58 45.65 19.66 65.5 — Oct. 1972 30 reg. 11.7 21.55 9.48 12.81 32.91 32.38 29.06 65.5 — Sept. 1972 30 reg. 12.20 16.32 2.69 27.15 45.58 19.66 65.5 — Sept. 1972 30 reg. 3.50 18.30 18.91 9.23 2.60 27.25 45.58 19.69 16.11 57.55 10.90 34.50 10.90 34.50 10.90 34.50 10.90 34.50 10.90 34.50 10.90 34.50 10.90 34.50 10.90 34.50 10.90 34.50 10.90 10.90 10.90 10.90 10.90 10.90 10.90 10.90 10.90	1991	100	30 reg.	8.67		7.31	9.21	2.18		26.71	9.64	
do Oct, 1972 30 reg. 1.17 21.56 9.28 7.72 2.21 20.58 45.65 19.66 65. iamt) July, 1972 40 old, 21.07 12.25 10.81 11.84 3.14 23.91 32.38 29.09 61.19 Sept. 1972 30 reg. 12.20 16.32 9.48 12.88 3.119 23.56 10.90 34.61 3.91 32.38 29.09 61.10 39.20 39.00 34.11 37.25 45.38 29.09 61.11 57.25 41.50 16.11 57.25 41.50 16.11 57.25 41.50 16.11 57.25 41.50 16.11 57.25 41.50 16.11 57.25 41.50 16.11 57.25 41.50 16.11 57.25 41.50 16.11 57.25 41.50 16.11 57.25 41.50 16.11 57.25 41.50 16.11 57.25 41.50 16.11 57.25 41.50 16.11 57.25 41.50 16.11 57.25 <td>do— Oct. 1972 30 reg. 1.17 21.56 9.28 7.72 2.21 20.58 45.65 19.66 65. July, 1972 40 old, 21.07 12.25 10.81 11.84 3.14 23.91 32.38 29.09 61. Sept. 1972 30 reg. 12.20 16.32 9.48 12.88 1.89 21.19 23.65 10.90 34. Oct. 1972 30 reg. 6.30 16.37 9.49 9.28 1.89 21.19 23.65 10.90 34. Oct. 1972 30 reg. 6.30 18.50 8.30 10.80 1.57 26.72 41.50 16.11 57. Oct. 1972 55 old, 3.64 22.37 7.16 8.16 3.80 27.66 9.53 3.52 13. Insss July, 1972 65 old, 2.94 15.63 8.23 9.08 2.44 28.59 19.69 13.22 32. Aug, 1972 30 reg. 6.33 21.78 8.06 7.62 2.25 22.65 9.31 5.99 11.00 0ct. 1972 30 reg. 11.00 12.67 9.91 11.48 2.35 22.66 5.31 15.40 9.42 24.00 0ct. 1972 30 reg. 11.00 12.67 9.91 11.48 2.35 22.36 66.01 20.87 86.00 1973 30 reg. 11.00 12.67 9.91 11.48 2.35 22.36 66.01 20.87 86.00 1973 30 reg. 11.00 12.67 9.91 11.48 2.35 22.36 66.01 20.87 86.00 1973 30 reg. 11.30 12.67 9.91 11.48 2.35 22.36 66.01 20.87 86.00 1973 30 reg. 11.30 12.67 9.91 11.48 2.35 22.36 66.01 20.87 86.00 1973 30 reg. 11.30 12.45 11.76 2.41 13.42 24.30 1974 45 reg. 24.31 13.98 12.45 11.76 2.41 13.42 24.50 30.90 88.00 1974 45 reg. 28.37 12.26 11.06 3.42 24.03 30.60 84.00 1974 45 reg. 28.37 12.26 11.06 3.47 28.28 32.73 30.29 68.10 10.00 10.</td> <td>1991</td> <td></td> <td>30 reg.</td> <td>3.83</td> <td></td> <td>9.47</td> <td>10.02</td> <td>3.95</td> <td></td> <td>37.76</td> <td>10.21</td> <td></td>	do— Oct. 1972 30 reg. 1.17 21.56 9.28 7.72 2.21 20.58 45.65 19.66 65. July, 1972 40 old, 21.07 12.25 10.81 11.84 3.14 23.91 32.38 29.09 61. Sept. 1972 30 reg. 12.20 16.32 9.48 12.88 1.89 21.19 23.65 10.90 34. Oct. 1972 30 reg. 6.30 16.37 9.49 9.28 1.89 21.19 23.65 10.90 34. Oct. 1972 30 reg. 6.30 18.50 8.30 10.80 1.57 26.72 41.50 16.11 57. Oct. 1972 55 old, 3.64 22.37 7.16 8.16 3.80 27.66 9.53 3.52 13. Insss July, 1972 65 old, 2.94 15.63 8.23 9.08 2.44 28.59 19.69 13.22 32. Aug, 1972 30 reg. 6.33 21.78 8.06 7.62 2.25 22.65 9.31 5.99 11.00 0ct. 1972 30 reg. 11.00 12.67 9.91 11.48 2.35 22.66 5.31 15.40 9.42 24.00 0ct. 1972 30 reg. 11.00 12.67 9.91 11.48 2.35 22.36 66.01 20.87 86.00 1973 30 reg. 11.00 12.67 9.91 11.48 2.35 22.36 66.01 20.87 86.00 1973 30 reg. 11.00 12.67 9.91 11.48 2.35 22.36 66.01 20.87 86.00 1973 30 reg. 11.30 12.67 9.91 11.48 2.35 22.36 66.01 20.87 86.00 1973 30 reg. 11.30 12.67 9.91 11.48 2.35 22.36 66.01 20.87 86.00 1973 30 reg. 11.30 12.45 11.76 2.41 13.42 24.30 1974 45 reg. 24.31 13.98 12.45 11.76 2.41 13.42 24.50 30.90 88.00 1974 45 reg. 28.37 12.26 11.06 3.42 24.03 30.60 84.00 1974 45 reg. 28.37 12.26 11.06 3.47 28.28 32.73 30.29 68.10 10.00 10.	1991		30 reg.	3.83		9.47	10.02	3.95		37.76	10.21	
innt) July, 1972 40 old, 21.07 12.25 10.81 11.84 3.14 23.91 32.38 29.09 61. Aug. 1972 30 reg. 12.20 16.32 9.48 12.88 1.89 21.19 23.65 10.90 34. Sept. 1972 30 reg. 12.20 16.32 9.48 12.88 1.89 21.19 23.65 10.90 34. Oct. 1972 30 reg. 3.50 12.47 9.19 9.23 2.60 27.25 45.58 13.58 59. (J.S. 263) Oct. 1972 55 old, 4.76 16.25 8.55 9.60 4.71 29.36 34.00 19.75 53. Trass July, 1972 65 old, 2.94 15.63 8.23 9.08 2.44 28.59 19.69 19.75 53. Aug. 1972 30 reg. 21.25 26.01 9.46 8.82 2.25 22.65 5.31 5.99 10.00 19.75 20.00 0ct. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24.00 19.75 11.00 10.00 10.00 19.46 8.82 2.18 26.47 0.78 2.22 3.00 10.00 19.45 11.00 10.00 19.45 11.00 10.00 19.45 11.00 10.00 19.45 11.00 10.00 19.45 11.00 10.00 19.45 11.00 10.00 19.45 11.00 10.00 19.45 11.00 10.00 19.45 11.00 10.00 19.45 11.00 10.00 19.45 11.00 10.00 19.45 11.00 10.00 19.45 11.00 10.00 19.45 11.00 10.00 19.95 11.00 19.90 12.67 11.00 19.90 12.67 11.00 19.90 12.67 11.00 19.90 12.67 11.00 19.90 12.67 11.00 19.90 19.95 11.00 19.95 11.00 19.95 11.00 19.95 11.00 19.95 11.00 19.90	innt) July, 1972 40 old, 21.07 12.25 10.81 11.84 3.14 23.91 32.38 29.09 61. Aug. 1972 30 reg. 12.20 16.32 9.48 12.88 1.89 21.19 23.65 10.90 34. Sept. 1972 30 reg. 6.30 12.47 9.19 9.23 2.60 27.25 45.88 13.58 39. Oct. 1972 30 reg. 6.30 12.47 9.19 9.23 2.60 27.25 45.88 13.58 39. (J.S. 263) Oct. 1972 55 old, 3.64 22.37 7.16 8.16 3.80 27.66 9.53 3.52 13. Oct. 1972 50 old, 4.76 16.25 8.55 9.60 4.71 29.36 34.00 19.75 53. Inly, 1972 65 old, 2.94 15.63 8.23 9.08 2.44 28.59 19.69 19.75 53. Aug. 1972 30 reg. 11.06 16.69 8.88 8.34 1.99 24.53 15.40 9.42 24. Sep. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. Nov. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. Nov. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. Sep. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. Sep. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. Nov. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. Sep. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 16.00 1.00 8.41 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1	-00-	11.36	30 reg.	1.17		9.28	7.72	2.21		45.65	19.66	
Sept. 1972 30 reg. 6.30 12.47 9.19 9.23 2.60 27.25 45.58 13.58 59. Ct. 1972 30 reg. 6.30 12.47 9.19 9.23 2.60 27.25 45.58 13.58 59. Ct. 1972 30 reg. 6.30 12.47 9.19 9.23 2.60 27.25 45.58 13.58 59. Ct. 1972 55 old, 3.64 22.37 7.16 8.16 3.80 27.66 9.53 3.52 13. Springs oct. 1972 55 old, 4.76 16.25 8.55 9.60 4.71 29.36 9.53 3.52 13. Springs oct. 1972 50 old, 4.76 16.25 8.55 9.60 4.71 29.36 9.53 3.52 13. Springs oct. 1972 30 reg. 21.25 26.07 2.25 2.25 5.31 5.99 11. Springs oct. 1972 30 reg. 21.25 26.01 9.46 8.82 2.18 26.47 0.78 2.22 3. Springs oct. 1972 30 reg. 11.06 16.09 8.58 8.34 1.99 24.53 15.40 9.42 24. Springs oct. 1972 30 reg. 11.06 16.09 8.58 8.34 1.99 24.53 15.40 9.42 24. Springs oct. 1972 30 reg. 11.09 12.67 9.91 11.48 2.35 22.36 66.01 20.87 86. Springs oct. 1973 30 reg. 11.57 14.54 1.90 24.53 15.40 9.42 24. Springs oct. 1973 30 reg. 14.52 14.54 1.76 1.92 29.55 36.91 23.91 60. June 1973 50 reg. 44.31 13.98 12.45 11.76 2.41 31.42 16.70 14.87 31. Springs oct. 1974 30 reg. 21.53 12.54 11.76 2.41 31.42 16.70 14.87 31. Springs oct. 1974 45 reg. 28.37 12.26 14.57 16.26 25.56 37.65 30.99 88. June 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.	Aug. 1972 30 reg. 6.30 12.47 9.19 9.23 2.60 27.25 45.58 19.30 34. Sept. 1972 30 reg. 6.30 12.47 9.19 9.23 2.60 27.25 45.58 19.38 59. Oct. 1972 30 reg. 6.30 12.47 9.19 9.23 2.60 27.25 45.58 13.58 59. (J.S. 263) Oct. 1972 55 old, 4.76 16.25 8.55 9.60 4.71 29.36 9.51 15.75 15.81 15.70 16.11 57. Oct. 1972 30 reg. 6.33 21.47 8.29 9.08 2.44 28.59 19.69 19.75 53. July, 1972 65 old, 2.94 15.63 8.23 9.08 2.44 28.59 19.69 19.75 53. Aug. 1972 30 reg. 21.25 26.01 9.46 8.82 2.18 26.47 0.78 2.22 13. Sep. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. Oct. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. Aug. 1973 30 reg. 11.09 12.67 9.91 11.48 2.35 22.36 66.01 20.87 86. June 1973 50 reg. 44.31 13.98 12.45 11.76 2.41 31.42 16.70 14.87 31. June 1973 50 reg. 24.73 13.98 12.45 11.76 2.41 31.42 16.70 14.87 31. June 1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 49. 30.99 88. June 1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. June 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.18 32.73 30.29 63.	t (Giant)		40 old	21 07		10.81	11.84	3.14		32.38	29.09	
Chui, 1972 30 reg. 5.30 12.47 9.19 9.23 2.60 27.25 45.38 13.88 59.23 Oct. 1972 30 reg. 3.50 12.47 9.19 9.23 2.60 27.25 45.38 13.88 59. (J.S. 263) Oct. 1972 30 reg. 3.50 18.50 8.30 10.80 1.57 26.72 41.50 16.11 57. (J.S. 263) Oct. 1972 30 reg. 3.50 4.76 16.25 8.55 9.60 4.71 29.36 34.00 19.75 53. do- Aug. 1972 50 old. 2.94 15.63 8.23 9.60 4.71 29.36 19.75 53. 13. 40. 19.75 53. 13. 53. 11. 50. 11. 57. 44. 0.78 35. 13. 59. 11. 57. 44. 0.78 35. 36. 11. 57. 44. 18. 36. 11. 20.56 5.31 <td>Ch. 1972 30 reg. 5.30 12.47 9.19 9.23 2.60 27.25 45.88 13.88 99.23 2.60 27.25 45.88 13.88 99.23 2.60 27.25 45.88 13.88 99.23 2.61 1972 30 reg. 5.50 dd. 3.64 22.37 7.16 8.16 3.80 27.66 9.53 3.52 13.89 20.0ct, 1972 55 old, 4.76 16.25 8.55 9.60 4.71 29.36 34.00 19.75 53.10 do. do. do. do. do. do. do. do. do. do.</td> <td>t (Chann)</td> <td></td> <td>30 200</td> <td>12 20</td> <td></td> <td>0 48</td> <td>12 88</td> <td>1 89</td> <td></td> <td>23 65</td> <td>10 90</td> <td></td>	Ch. 1972 30 reg. 5.30 12.47 9.19 9.23 2.60 27.25 45.88 13.88 99.23 2.60 27.25 45.88 13.88 99.23 2.60 27.25 45.88 13.88 99.23 2.61 1972 30 reg. 5.50 dd. 3.64 22.37 7.16 8.16 3.80 27.66 9.53 3.52 13.89 20.0ct, 1972 55 old, 4.76 16.25 8.55 9.60 4.71 29.36 34.00 19.75 53.10 do.	t (Chann)		30 200	12 20		0 48	12 88	1 89		23 65	10 90	
Oct. 1972 30 reg. 3.50 18.50 8.30 10.80 1.57 26.72 41.50 16.11 57. (U.S. 263) Oct. 1972 55 old. 4.76 16.25 8.55 9.60 4.71 29.36 9.53 3.52 13. (U.S. 263) Oct. 1972 55 old. 4.76 16.25 8.55 9.60 4.71 29.36 9.50 19.75 53. (U.S. 263) Oct. 1972 50 old. 4.76 16.25 8.53 9.08 2.44 28.59 19.69 19.75 53. (U.S. 263) Oct. 1972 30 reg. 21.25 26.01 9.46 8.82 2.18 26.47 0.78 2.22 3. (U.S. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. (U.S. 20.60 19.75 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. (U.S. 20.60 19.75 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. (U.S. 20.60 19.75 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. (U.S. 20.60 19.75 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. (U.S. 20.60 19.75 30 reg. 11.06 12.07 14.54 12.30 2.13 23.92 64.44 15.37 79 10.38 19.39 19.30 19.39 1	Oct. 1972 30 reg. 3.50 18.50 8.30 10.80 1.57 26.72 41.50 16.11 57. (D.G. Pearl) Oct. 1972 55 old. 4.76 16.25 8.55 9.60 4.71 29.36 94.00 19.75 53. (J.S. 263) Oct. 1972 55 old. 4.76 16.25 8.55 9.60 4.71 29.36 94.00 19.75 53. (J.S. 263) Oct. 1972 55 old. 2.94 15.63 8.23 9.08 2.44 28.59 19.69 13.22 32. Aug. 1972 65 old. 2.94 15.63 8.23 9.08 2.44 28.59 19.69 13.22 32. Aug. 1972 30 reg. 21.25 26.01 9.46 8.82 2.18 26.47 0.78 2.22 3. Sep. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. Oct. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. Nov. 1972 35 reg. 11.06 12.07 9.91 11.48 2.35 22.36 66.01 20.87 86. Aug. 1973 80 old. 28.82 14.52 12.76 14.54 2.60 29.92 27.23 14.68 41. June 1973 50 reg. 21.53 9.63 13.20 1.92 29.55 36.91 60. Aug. 1974 60 old. 11.46 17.01 13.04 11.76 3.52 27.94 54.09 30.60 84. June 1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. June 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.15 45.16 41.34 86.	100	The same	30 reg	6 30		0 10	0.23	2 60		45 58	13.58	
(I.S. 263) Oct. 1972 55 old. 3.64 22.37 7.16 8.16 3.80 27.66 9.53 3.52 13. (I.S. 263) Oct. 1972 55 old. 4.76 16.25 8.55 9.60 4.71 29.36 34.00 19.75 53. (I.S. 263) Oct. 1972 56 old. 4.76 16.25 8.23 9.08 2.44 28.59 19.69 13.22 32. Aug. 1972 65 old. 2.94 15.63 8.23 9.08 2.44 28.59 19.69 13.22 32. Aug. 1972 67 oreg. 21.25 26.01 9.46 8.82 2.18 26.47 0.78 2.22 3. Sep. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. Aug. 1972 80 old. 2.85 14.64 9.30 9.36 2.13 29.2 44.4 15.37 16.16 16.10 19.30 12.13 11.48 2.35 22.36 66.01 20.87 86. Aug. 1973 80 old. 2.8 21.25 12.76 14.54 2.60 29.92 27.23 14.68 4.11 11.00 19.3 16.36 13.20 1.92 29.55 36.91 23.91 60. Aug. 1973 50 reg. 44.31 13.98 12.45 11.76 2.41 31.42 16.70 14.87 31. Aug. 1974 30 reg. 24.73 12.26 14.76 16.26 28.55 36.91 23.91 60. Aug. 1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. June 1974 60 reg. 10.36 4 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.	(I.S. 263) Oct. 1972 55 old. 3.64 22.37 7.16 8.16 3.80 27.66 9.53 3.52 13. (I.S. 263) Oct. 1972 55 old. 4.76 16.25 8.55 9.60 4.71 29.36 34.00 19.75 53. Irass July, 1972 65 old. 2.94 15.63 8.23 9.08 2.44 28.59 19.69 13.22 32. Aug. 1972 30 reg. 21.25 26.01 9.46 8.82 2.18 26.47 0.78 2.22 3. Aug. 1972 60 reg. 21.25 26.01 9.46 8.82 2.18 26.47 0.78 2.22 3. Aug. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. Aug. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. Aug. 1972 30 reg. 11.09 12.67 9.91 11.48 2.35 22.36 66.01 20.87 86. Aug. 1973 30 reg. 13.55 14.64 9.30 9.36 2.13 23.92 64.44 15.37 79. June 1973 30 reg. 21.53 16.36 13.20 1.92 29.55 36.91 23.91 60. Aug. 1974 60 old. 11.46 17.01 13.08 12.66 1.65 25.63 57.65 30.99 88. June 1974 45 reg. 28.37 12.26 14.77 16.26 1.65 25.63 57.65 30.99 88. June 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.15 45.16 41.34 86.	90		30 reg.	3 50		8 30	10.80	1 57		41 50	16.11	
Till Constitution of the c	Tilly, 1972 50 old, 4.76 16.25 8.55 9.60 4.71 29.36 34.00 19.75 53. Trans. July, 1972 50 old, 4.76 16.25 8.55 9.60 4.71 29.36 34.00 19.75 53. Trans. July, 1972 50 old, 4.76 16.25 8.23 9.08 2.44 28.59 19.69 13.22 32. Aug, 1972 30 reg, 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. Aug, 1972 30 reg, 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. Aug, 1973 30 reg, 11.09 12.67 9.91 11.48 2.35 22.36 66.01 20.87 86. Aug, 1973 30 reg, 13.55 14.64 9.30 9.36 2.13 2.92 64.44 15.37 79. June 1973 50 reg, 44.31 13.98 12.45 11.76 2.41 31.42 16.70 14.87 31. Aug, 1974 60 reg, 10.36 12.52 11.16 3.42 28.15 45.60 19.95 65. June 1974 45 reg, 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. June 1974 60 reg, 103.64 20.84 15.10 9.90 3.47 28.15 45.16 41.34 86.	(D C Door!)	200	55 old	3.50		7 16	8 16	3.80		9.53	3 52	
rass July, 1972 Aug, 1973 Aug, 1973 Aug, 1973 Aug, 1974 Aug,	rass July, 1972 July, 1973 July, 1973 July, 1974 July,	um (I.S. 263)	100	50 old.	4.76		8.55	09.6	4.71		34.00	19.75	
July, 1972 65 old. 2.94 15.63 8.23 9.08 2.44 28.59 19.69 13.22 32. do	July, 1972 65 old, 2.94 15.63 8.23 9.08 2.44 28.59 19.69 13.22 32. do. Aug, 1972 30 reg. 6.33 21.78 8.06 7.62 2.25 22.65 5.31 5.99 11. do. Sep. 1972 30 reg. 11.05 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. do. Oct. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. do. Oct. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. do. Oct. 1972 30 reg. 11.06 12.09 11.48 2.35 22.36 66.01 20.87 86. do. June 1973 30 reg. 11.35 14.64 9.30 9.36 2.13 23.92 64.44 15.37 79. do. June 1973 30 reg. 44.31 13.98 12.45 11.76 2.41 31.42 16.70 14.87 31. do. April 1974 60 old. 11.46 17.01 13.04 11.76 3.52 27.94 54.09 30.60 84. do. June 1974 45 reg. 28.37 12.26 14.77 16.26 1.65 25.63 57.65 30.99 88. June 1974 60 reg. 10.36 12.35 11.16 3.42 28.15 45.16 41.34 86. do. June 1974 60 reg. 10.36 2.35 11.16 3.42 28.15 45.16 41.34 86. do. June 1974 60 reg. 10.36 12.52 11.16 3.42 28.15 45.16 41.34 86. do. June 1974 60 reg. 10.36 42.08 41.510 9.90 3.47 28.28 32.73 30.29 63.	n Grass											
do Aug, 1972 30 reg. 6.33 21.78 8.06 7.62 2.25 22.65 5.31 5.99 11. do Aug, 1972 60 reg. 21.25 26.01 9.46 8.82 2.18 26.47 0.78 2.22 3. do Oct, 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. do Oct, 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24.	do Aug, 1972 30 reg. 6.33 21.78 8.06 7.62 2.25 22.65 5.31 5.99 11. do Sep. 1972 30 reg. 21.25 26.01 9.46 8.82 2.18 26.47 0.78 2.22 3. do Sep. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24. do Oct, 1972 30 reg. 11.06 16.69 9.88 3.4 1.99 24.53 15.40 9.42 24. do Oct, 1972 33 reg. 11.06 16.69 9.36 9.36 2.13 25.92 64.44 15.37 79. do June 1973 30 reg. 14.52 12.76 14.54 2.60 29.92 27.23 14.68 41.66 41.87 11.76 2.41 15.37 79. do June 1973 30 reg. 44.31 13.04 11.76 3.52 27.94	ghum)	-					80.6	2.44			13.22	
do_ Aug. 1972 60 reg. 21.25 26.01 9.46 8.82 2.18 26.47 0.78 2.22 3.7 do_ Sep. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24.24 do_ Oct, 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24.24 do_ Nov, 1972 35 reg. 11.06 12.67 9.91 11.48 2.35 23.92 64.44 15.37 79 do_ Nov, 1973 80 old. 28.82 12.76 2.95 29.55 36.44 15.37 79 do_ June 1973 30 reg. 44.31 13.98 12.45 11.76 2.41 31.42 16.06 29.95 36.91 23.91 60 do_ Aug. 1974 30 reg. 11.46 17.01 13.04 11.48 17.16 3.52 27.94 54.09 3	do Aug. 1972 60 reg. 21.25 26.01 9.46 8.82 2.18 26.47 0.78 2.22 3 do Oct, 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24, 24, 24, 24, 24, 24, 24, 24, 23 24, 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24, 24, 24, 24, 24, 24, 24, 24, 24, 24,	-do-						7.62	2.25			5.99	
do- Sep. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24.24 do- Oct. 1972 30 reg. 11.09 12.67 9.91 11.48 2.35 22.36 66.01 20.87 86. do- Nov. 1972 35 reg. 13.55 14.64 9.30 9.36 2.13 29.35 46.44 18.37 79. fullet hybrid. May 1973 80 old. 28.82 14.52 12.67 1.92 29.35 36.91 20.87 86. do- June 1973 30 reg. 44.31 13.98 12.45 11.76 2.41 314.22 14.69 44.87 13.04 46.04 44.87 46.04 44.87 44.87 46.04 46.04 44.87 46.04 46.04 46.04 46.04 46.04 46.04 46.04 46.04 46.04 46.04 46.04 46.04 46.04 46.04 46.04 46.04 46.04 4	do- Sep. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24.24 do- Oct. 1972 30 reg. 11.06 16.69 8.58 8.34 1.99 24.53 15.40 9.42 24.24 do- Nov. 1972 35 reg. 11.64 9.30 9.36 2.13 25.36 66.01 20.87 86.01 do- June 1973 30 reg. 31.03 10.33 16.36 13.20 1.92 29.55 36.91 20.87 79.60 do- June 1973 50 reg. 44.31 13.98 12.45 11.76 2.41 31.42 16.0 14.87 31.60 do- Aug. 1974 45 reg. 24.73 13.04 11.76 3.52 27.94 54.09 30.60 88. do- June 1974 45 reg. 28.37 12.52 11.16 3.42 28.15 45.16 30.99 88. do- <t< td=""><td>1901</td><td></td><td></td><td></td><td></td><td></td><td>8.82</td><td>2.18</td><td></td><td></td><td>2.22</td><td></td></t<>	1901						8.82	2.18			2.22	
do- Oct, 1972 30 reg. 11.09 12.67 9.91 11.48 2.35 22.36 66.01 20.87 86. do- Nov. 1972 35 reg. 13.55 14.64 9.30 9.36 2.13 23.92 64.44 15.37 79. do- June 1973 30 reg. 41.52 12.76 14.54 2.60 29.92 27.23 14.68 41. do- June 1973 30 reg. 44.31 13.98 12.45 11.76 29.55 36.91 23.91 60. do- Aug. 1973 45 reg. 21.53 9.63 14.87 31. 2.41 31.42 16.70 14.87 31. do- April 1974 60 old. 11.46 17.01 13.04 11.76 3.52 27.94 54.09 30.60 84. do- June 1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. d	do- Oct, 1972 30 reg. 11.09 12.67 9.91 11.48 2.35 22.36 66.01 20.87 86. do- Nov. 1972 35 reg. 13.55 14.64 9.30 9.36 2.13 23.92 64.44 15.37 79. do- June 1973 30 reg. 31.03 10.33 16.36 13.20 29.95 55.95 54.44 15.37 79. do- June 1973 30 reg. 44.31 13.98 12.45 11.76 2.41 31.42 16.70 14.87 31. do- April 1974 60 old. 11.46 17.01 13.04 11.76 3.52 27.94 54.09 30.60 84. do- May 1974 30 reg. 24.73 12.26 14.77 16.26 1.65 25.63 57.65 30.99 88. do- June 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 35.75 30.29	199						8.34	1.99			9.42	
do- Mov. 1972 Mov. 1972 Mov. 1972 Mov. 1972 Mov. 1973 Mov. 1974 Mov. 1974 Mov. 1974 Mov. 1974 Mov. 1974 Mov. 1975 Mov. 1975 Mov. 1975 Mov. 1975 Mov. 1975 Mov. 1973 Mov. 1974 Mov. 1974 Mov. 1975 Mov. 19	do— Nov. 1972 35 reg. 13.55 14.64 9.30 9.36 2.13 23.92 64.44 15.37 79. fillet hybrid. May 1973 80 old. 28.82 14.52 12.76 14.54 2.60 29.92 27.23 14.68 41. do— June 1973 30 reg. 44.31 13.98 12.45 11.76 2.41 31.42 16.70 14.87 31. do— April 1974 60 old. 11.46 17.01 13.04 11.76 3.52 27.94 54.09 30.60 84. do— May 1974 30 reg. 24.73 12.26 14.77 16.26 1.65 25.63 57.65 30.99 88. June 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.15 45.16 41.34 86. June 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.	199-						11.48	2.35			20.87	
fillet hybrid. May 1973 80 old. 28.82 14.52 12.76 14.54 2.60 29.92 27.23 14.68 41. do— June 1973 30 reg. 31.03 10.33 16.36 13.20 1.92 29.55 36.91 23.91 60. do— Aug. 1973 45 reg. 21.53 9.63 14.52 11.76 2.41 31.42 16.70 14.87 31. do— April 1974 60 old. 11.46 17.01 13.04 11.76 3.52 27.94 54.09 30.60 84. June 1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. June 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.	fillet hybrid. May 1973 80 old. 28.82 14.52 12.76 14.54 2.60 29.92 27.23 14.68 41. do— June 1973 30 reg. 31.03 10.33 16.36 13.20 1.92 29.55 36.91 23.91 60. do— Aug. 1973 45 reg. 21.53 9.63 14.77 16.26 2.83 2.85 36.91 23.91 60. May 1974 60 old. 11.46 17.01 13.04 11.76 3.52 27.94 54.09 30.69 84. do— June 1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. June 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.	19-6						9.36	2.13			15.37	
do— June 1973 30 reg. 31.03 10.33 16.36 13.20 1.92 29.55 36.91 23.91 60. do— June 1973 50 reg. 44.31 13.98 12.45 11.76 2.41 31.42 16.70 14.87 31. do— April 1974 60 old. 11.46 17.01 13.04 11.76 2.56 27.94 54.09 30.69 84. do— June 1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. June 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.	do- June 1973 30 reg. 31.03 10.33 16.36 13.20 1.92 29.55 36.91 23.91 60. do- June 1973 50 reg. 44.31 13.98 12.45 11.76 2.41 31.42 16.70 14.87 31. do- April 1974 60 old. 11.46 17.01 13.04 11.76 3.52 27.94 54.09 30.60 84. do- June 1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. June 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.	or Millet hvhrid	100					14.54	2.60			14.68	
1973 50 reg. 44.31 13.98 12.45 11.76 2.41 31.42 16.70 14.87 31.11 1973 45 reg. 21.53 9.63 14.52 10.38 2.68 29.55 45.60 19.95 65.11 11974 60 old. 11.46 17.01 13.04 11.76 3.52 27.94 54.09 30.60 84.11 1974 30 reg. 24.73 12.26 14.77 16.26 1.65 25.63 57.65 30.99 88.19 1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86.13 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.	June 1973 50 reg. 44.31 13.98 12.45 11.76 2.41 31.42 16.70 14.87 31. Aug. 1973 50 reg. 21.53 9.63 14.52 10.38 2.68 29.55 45.60 19.95 65. April 1974 60 old. 11.46 17.01 13.04 11.76 3.52 27.94 54.09 30.60 84. June 1974 45 reg. 24.73 12.26 14.77 16.26 1.65 25.63 57.65 30.99 88. June 1974 60 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. June 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.	do						13.20	1.92			23.91	
1973 45 reg. 21.53 9.63 14.52 10.38 2.68 29.55 45.60 19.95 65. 11974 60 old. 11.46 17.01 13.04 11.76 3.52 27.94 54.09 30.60 84. 1974 30 reg. 24.73 12.26 14.77 16.26 1.65 25.63 57.65 30.99 88. 1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.	Aug. 1973 45 reg. 21.53 9.63 14.52 10.38 2.68 29.55 45.60 19.95 65. April 1974 60 old. 11.46 17.01 13.04 11.76 3.52 27.94 54.09 30.60 84. May 1974 30 reg. 24.73 12.26 14.77 16.26 1.65 25.63 57.65 30.99 88. June 1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. June 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.	90						11.76	2.41			14.87	
11974 60 old. 11.46 17.01 13.04 11.76 3.52 27.94 54.09 30.60 84. 1974 30 reg. 24.73 12.26 14.77 16.26 1.65 25.63 57.65 30.99 88. 1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.	April 1974 60 old. 11.46 17.01 13.04 11.76 3.52 27.94 54.09 30.60 84. May 1974 30 reg. 24.73 12.26 14.77 16.26 1.65 25.63 57.65 30.99 88. June 1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. June 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.							10.38	2.68			19.95	
1974 30 reg. 24.73 12.26 14.77 16.26 1.65 25.63 57.65 30.99 88. 1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.	May 1974 30 reg. 24.73 12.26 14.77 16.26 1.65 25.63 57.65 30.99 88. June 1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. June 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.	100						11.76	3.52			30.60	
1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.	June 1974 45 reg. 28.37 12.36 12.52 11.16 3.42 28.15 45.16 41.34 86. June 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.	1						16.26	1.65			30.99	
1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.	June 1974 60 reg. 103.64 20.84 15.10 9.90 3.47 28.28 32.73 30.29 63.		1					11.16	3.42			41.34	
	1000 ml	100	nuls					06.6	3.47			30.29	
2000 m.													

TABLE 1

The Effect of Moisture Contents on the Extractability and Quality of Proteins.

-												
7		Water	Ist Extraction	ction	2nd Extraction	action	3rd Extraction	action	Tota	Total Extraction.	+	%
Š	Species.	added.	NA NA	NPN	PN	NPN	NA.	NPN	PN	NPN	PN+ NPN	Total Ex- tractability
1.	Millet (B—18)	Thurst The	4.40	1.20	5.76	2.12	4.51	1.45	14.67	4.77	19.44	21
		1000 ml.	10.03	4.56	8.50	2.28	2.60	1.45	24.13	8.29	32.42	11.99
7.	Millet (Ex-Borneu)	1	13.83	6.35	13.83	2.63	10.09	3.23	37.75	12.21	49.86	1
		1000 ml.	19.52	7.00	13.11	3.89	9.76	2.75	42.39	13.64	56.03	12.15
3.	Millet (Giant).	1	18.26	6.37	16.57	4.48	10.72	2.73	45.55	13.58	59.13	1
. do :-		1000 ml.	33.40	12.86	22.61	12.86	10.00	3.18	66.01	28.90	94.91	60.51
4.	Sorghum (D.G. Pearl).	1	3.59	1.47	3.08	1.25	2.86	0.81	9.53	3.53	13.06	1
		1500 ml.	8.36	77.7	8.21	3.81	6.82	1.98	23.39	13.56	36.95	182.92
5.	Sorghum (J.S. 263).	1	13.88	7.50	12.31	7.31	7.81	4.93	34.00	19.74	53.74	1
		1500 ml.	17.94	12.81	13.88	8.00	8.44	4.25	40.26	25.06	65.32	21.55
	0.00				100	93						
					TABLE III	I.						
		Š	Crude and Extractable Protein in Grasses	xtractabl	e Protein	in Grass	ses					

Sr. Species No.	Yield Tons/ha.	Total Cuts/year.	Protein % N+6.00	PN % (Extractable)	Crude Protein	Yield of Ext. Protein Kg/ha/y
	13.0		10.6	0 30	181	76.0
Maize (Syn. 200)	8.8	Man countries ner v	6.6	47.6	94.8	46.0
	10.7		4.8	33.6	127.0	42.7
	30.0	5	10.4	30.0	622.6	186.8
. Millet (Ex-Borneu)	26.0	5	8.9	42.0	335.8	141.0
. Millet (Giant)	20.0	5	11.2	55.0	914.3	502.9
Sudan Grass (Sorghum)	55.0	7	8.5	50.0	702.4	351.2