Range Mgmt. & Agroforestry 34 (2) : 214-220, 2013
ISSN 0971-2070

Biomass production and quality of promising genotypes of *Chrysopogon fulvus* (Spreng.) Chiov. as influenced by fertility levels and cutting management

Sunil Kumar, A. K. Roy and S. A. Faruqui
All India Coordinated Research Project on Forage Crops
Indian Grassland and Fodder Research Institute Jhansi - 284003 Uttar Pradesh, India
Corresponding author email: sktiwari98@gmail.com
Received: 13th June, 2012 Accepted: 29th May, 2013

Abstract
Performance of some promising genotypes of *Chrysopogon fulvus* (Spreng.) Chiov. was studied under the influence of fertility levels and cutting Intervals in central India. The effect on herbage production and quality of grass was assessed during four years (2004-05 to 2007-08) at Indian Grassland and Fodder Research Institute, Jhansi (India). The treatments consisting of three *Chrysopogon* genotype (IGC - 9901, IGC - 9902 & IGC - 9903), there fertility levels (control, 30 N + 20 P_2O_5 & 60 N + 40 P_2O_5 kg/ha) and two cutting intervals (30 & 60 days) were laid out in factorial randomized block design with three replications. The pooled data of four years revealed that *Chrysopogon* genotype IGC ï 9903 fertilized with 60 kg N + 40 kg P_2O_5/ha harvested at 60 days interval gave significantly higher ($P>0.05$) green fodder (19.86 t/ha), dry matter (5.06 t/ha) and crude protein yield (0.31 t/ha). It registered increase of 12.39, 35.65 and 29.17 percent when harvested at 30 days interval in green fodder, dry matter and crude protein yield, respectively. All genotypes performed significantly better at 60 days interval at each fertility level. The magnitude of difference was higher between control (unfertilized plots) and 30 N + 20 P_2O_5 for all growth yield and quality attributes studied. Neutral detergent fibre and acid detergent fibre increased with delay in harvesting from 30 to 60 days intervals, while crude protein content decreased with delay in cutting. This trend in quality parameters indicated that forage quality was superior at 30 days harvesting interval. However due to higher dry matter yield, the crude protein yield was superior with 60 days harvesting interval. Higher dry biomass, thus, compensated for the lower crude protein in all the *Chrysopogon* genotypes making this grass suitable to harvest at 60 days interval.

Keywords: Acid detergent fibre, *Chrysopogon*, Crude protein, Cutting interval, Fertility level, Forage yield, Genotype, Neutral detergent fibre, Perennial grass, Range grass

Introduction
Chrysopogon fulvus (Spreng.) Chiov. popularly known as Dhawlu or Phulkara grass in India is an important perennial grass of *Sehima-Dichanthium* cover. The grass is distributed over whole of peninsular India including central Indian plateau, South West Bengal, Bihar and Uttar Pradesh. (Dabadghao and Shankarnaryanan, 1973). It is a predominant grass in rangeland condition in semi arid, tropical and subtropical regions. It grows well in the dark gray, gravelly and well drained soil having rainfall of 500-900 mm. This grass is adaptable to a wide range of habitats on highly degraded hill slopes and serves as good forage resource for grazing and hay making. Forage production of grasses in semi arid region is directly influenced by initial establishment, subsequent management, edaphic and climatic conditions. Among the management factors, nutrient supplementation and cutting schedules are the major components in a grassland management. The present study was undertaken to find out most appropriate fertility levels and cutting schedules for promising *Chrysopogon* genotypes for obtaining higher biomass and quality fodder.

Materials and Methods
The study was undertaken during four consecutive years 2004-05 to 2007-08 at the Central Research Farm of the Indian Grassland and Fodder Research Institute, Jhansi (25°27'N, 78°37'E; 275 m above mean sea level). The soil was sandy loam, low in organic carbon (0.36), available nitrogen (165 kg/ha) and phosphorous (11.5 kg/ha) and medium in available potassium (242 kg/ha) at the start of the experiment in 0-15 cm soil depth. The experimental site is semiarid type with moderate rains, cold winters and hot desiccating summers. During the experimentation period, an average rainfall of 726 mm in 32 rainy days was received mostly between mid June to mid September. The treatments consisted of 18 combinations comprising of three *Chrysopogon* genotypes (IGC-9901, IGC-9902 and IGC-9903), three fertility levels

(Control, 30N+20P kg/ha and 60N+40P kg/ha) and two cutting intervals (30 and 60 days). The experiment was laid out in factorial randomized block design with three replications in plot size of 5m X 4m. Six week old seedlings of *Chrysopogon* were transplanted in the first week of July after first heavy rains. Seedlings were planted at a row-to-row distance of 50 cm and plant to plant 30 cm. Application of fertilizers was done as per treatments through urea and single super phosphate. In the establishment year, half dose of N and full dose of P_2O_5 was applied as basal and remaining half dose of N was top dressed in two equal splits *i.e*., after one month stage of the grass and subsequently at the time of intercultural operations at the first effective rains. In subsequent years, half dose of nitrogen only was applied. Intercultural operations were done once in the early growth period of grass during four experimental years. Every year the herbage was harvested manually as per harvesting schedule. Data on growth attributes was recorded at five randomly selected plants from each treatment. The values so obtained were averaged over the cuts and years. The data on yield were recorded at each cut and pooled. For estimation of dry matter, fresh plant samples (500g) were collected randomly from 0.50 cm x 0.50 cm quadrant in each treatment and dried in hot air oven at 80^0C to obtain dry weight. The herbage samples were analyzed for crude protein content as per methods described by AOAC (1995). Neutral detergent fibre (NDF) and acid detergent fibre (ADF) were estimated by the procedure established by Georing and Vansoest (1970). Soil samples at beginning and at the end of the experiment (four years) were collected. Changes in soil physical and chemical properties were analyzed following the standard methods. The data on growth and quality over cuts was pooled and statistically analyzed as suggested by Fisher (1950).

Results and Discussion

Growth characters

Pooled data of four years indicated that growth characters of *Chrysopogon* genotypes were influenced by fertility levels and cutting schedules (Table 1). IGC-9903 recorded significantly taller plants (99.62 cm) and higher number of tillers/plant (22.92) and clump diameter (10.30). The magnitude of increase in plant height among the genotypes ranged from 13.5 ï 15.0 and 20 ï 21 percent with fertility levels of 30 N + 20 P and 60 N + 40 P kg/ha over control, respectively. Significantly (P>0.05) taller plants were attained with IGC-9903 at 60 days of harvest when supplemented with 60 N + 40 P kg/ha. Tillers per plant were statistically at par with IGC-9901 and IGC- 9902 with interval of 30 and 60 days harvest. There was linear increase in tillers per plant with increasing levels of fertility. The increase in tillers number was almost equal when *Chrysopogon* was harvested after 60 days at each fertility level. Addition of 30 N + 20 P kg/ha and no fertilizer treatment realized equal tillers per plant when harvested at 30 days interval in case of all the three genotypes. Clump diameter (5.35 to 10.95) was also influenced due to different treatments. At two harvesting schedules, clump diameter of genotypes was non significant under unfertilized plots. The percentage increase in clump diameter in IGC-9903 at 30 days harvesting interval was by 27.3 and 17.5 over IGC-9901 and IGC-9902, respectively. The leaf stem ratio, leaf area index and dry matter accumulation exhibited superiority with IGC-9903 as compared to other genotypes (Table 1). Significantly higher leaf stem ratio was recorded at 60 days of harvest at each fertility level. Two harvesting schedules recorded statistically equal leaf stem ratio at all fertility levels studied. Leaf stem ratio increased linearly with increasing doses of N and P. The differences were greater between higher doses. At less interval, the succulence was more and proportion of leaf to stem was higher as compared to later stages. Leaf area index (LAI) showed similar trend. Significantly higher LAI (2.50) was recorded with IGC-9903 supplemented with 60 N + 40 P kg/ha and harvested after 60 days interval. Improvement in LAI was significant with each successive level of fertility. Dry matter accumulation (kg/m^2) was highly influenced by all the three factors and their combinations. Among genotypes, IGC-9903 showed superiority for dry matter accumulation in unit area. At all fertility levels, dry matter production was higher at 60 days interval harvesting. Significantly superior dry matter accumulation was attained with 60 N + 40 P kg/ha, which was 26.5 and 10.3 percent higher than 30 N + 20 P kg/ha and control, respectively.

The growth behaviour of IGC-9901 and IGC-9902 was almost similar and remained at par for all the growth attributes. The growth performance of the grass genotypes was better at 60 days interval harvest than 30 days. There was linear increase in growth attributes with increasing levels of fertility. Supplementation of N and P recorded significantly superior growth attributes over control. It has been postulated that leaf area index is the indirect measure of palatability (Misra and Misra, 1982). In this study, the most promising genotype attained higher L: S ratio and leaf area index, which indicated superiority in terms of forage quality. Trivedi (2001) reported that due to poor nutrient status of the grassland under semiarid situation, an increase of 20 and 22 percent in biomass was found with N (40 kg /ha) and P (25 kg/ha) alone, respectively.

Similarly Kumar *et al.* (2007) reported significant improvement in leaf: stem ratio and plant height of *Sehima nervosum* (Rottler) Stapf genotypes due to addition of 30N+20P kg/ha in medium fertile soil of semiarid region. Genotypic variation for different parameters were also observed in other perennial range grasses such as *Dichanthium* (Chandra *et al*., 2004), guinea grass (Jain *et al*., 2003), *Heteropogon* (Roy, 2004) and *Sehima* (Roy *et al*., 1999).

Herbage production

Pooled data of four years on biomass production of *Chrysopogon* was significantly influenced by genotypes, fertility levels and cutting schedules (Table 2). IGC-9903 supplemented with 60 kg N+ 40 kg P/ha and harvested at 60 days interval recorded significantly higher green fodder yield (19.86 t/ha) than other entries. It registered 12.4 percent increase over 30 days harvesting with similar fertility level. At lower fertility level (30N+20P kg/ha), IGC - 9902 and IGC-9903, were at par when harvested at 30 days interval. With delaying the harvesting schedule from 30 to 60 days and supplementing with 30N + 20P kg/ha , IGC-9903 recorded significantly higher green biomass (16.9 to 18.5 t/ha). IGC-9902 and IGC- 9903 remained at par at this level of fertility and 60 days of cutting schedule. Yield levels were lowest in control plots at 30 days cutting schedule with each genotype, which were non significant. Magnitude of increase was higher from control to 30 N + 20 P kg/ha. Herbage yield was significantly higher with harvesting schedule of 60 days at higher level of fertility. The plots receiving no fertilizer remained at par with two harvesting schedules of each genotype. With regard to dry matter yield, application of 60N+40Pkg/ha recorded significantly higher dry matter (5.1 t/ha) when harvested at 60 days interval than harvested at 30 days interval (3.7 t/ha). Dry matter yield was significantly superior at 60 days interval harvest with each fertility level and genotype. Application of 30N+20P kg/ha to *Chrysopogon* genotype IGC-9901 and IGC-9902 could not bring significant improvement in dry matter at 60 days harvest interval. The increase in dry matter yield was highest (68%) with IGC -9903 supplemented with 60N+40P kg/ha and harvested at 60 days interval as compared to control. Under rainfed conditions in wasteland, beneficial effect of introduction of *Stylosanthes seabrana* in *Chrysopogon* pasture has been studied by several workers. Niranjan *et al.* (1990) reported that the response of phosphorous was found up to 30 kg P_2O_5/ha. They further added that to obtain the maximum forage yield grass legume mixture needs to be fertilized with 45 kg N + 30 kg P_2O_5/ha. *Chrysopogon* a potential grass for drought prone areas in red and gravely soil with poor nutrient needs replenishment for exploitation of genetic potential (Dwivedi *et al.,* 1980).

Herbage quality

Forage quality of *Chrysopogon* genotypes measured in terms of crude protein (CP), neutral detergent fibre (NDF) and arid detergent fibre (ADF) was influenced by fertility and cutting management (Table 2). Significantly superior quality forage (CP-6.09%, NDF-64.33% and ADF-45.16%) was recorded with IGC-9903. Harvesting of grass at shorter interval (30 days) recorded higher CP content and lower ADF and NDF content in all the genotypes. There was increase of 1.3 to 3.0, 0.5 to 4.6 and 3.0 to 3.7 percent in CP content in 30 days interval harvest with control, 30 N + 20 P kg/ha and 60 N + 40 P kg/ha, respectively as compared to 60 days harvest. Contrast to this, ADF content was lower by 6.1 to 5.9, 2.5 to 5.6 and 3.0 to 4.6 percent when grass was harvested at 30 days interval and supplemented with no fertilizer, 30 N + 20 P kg/ha and 60 N + 40 P kg/ha, respectively, over 60 days harvest interval. In case of ADF, percent reduction with 30 days harvest interval over 60 days was recorded in the order of 7.0, 8.0 and 1.5 with no fertilizer, 30 N + 20 P kg/ha and 60 N + 40 P kg/ha, respectively. Significantly ($P>0.05$) superior grass quality (in terms of CP, NDF & ADF) was recorded in IGC-9903 with 60 N + 40 P kg/ha when harvested at 30 days interval. The higher crude protein content and lower neutral detergent fibre and acid detergent fibre with harvesting at 30 days may be ascribed to younger and succulent plants. Bora and Thakuria (2000) found that with the decrease in harvest interval, the crude protein content increased while neutral detergent fibre and acid detergent fibre decreased.

Crude protein yield was significantly influenced by fertility levels and cutting schedules. Significantly, higher crude protein yield was recorded with IGC-9903 when harvested at 60 days interval (0.31 t/ha) and 30 days interval (0.24 t/ha) with supplementation of 60 kgN+40kg P/ha. The differences between IGC-9901 and IGC-9902 were non-significant ($P>0.05$) both at 30 and 60 days interval of cutting at 60 N + 40 P kg /ha level of fertility. At lower dose of fertility, crude protein was not influenced due to genotypes. Harvesting of forage at interval of 60 days registered increase of 10 percent over 30 days with IGC-9902 and IGC-9903. Kumar *et al.,* (2007) also reported that *Sehima* fertilized with 60 N +40 kg P kg/ha harvested at 30 days interval produced 22-25 per cent higher crude protein yield over control.

Table 1. Influence of fertility levels and cutting intervals on growth attributes of *Chrysopogon* genotypes (mean of four years)

Genotype	Fertility levels (kg/ha) / harvesting interval (days)							
	Control		30 N + 20 P		60 N + 40 P		Mean	
	30	60	30	60	30	60	30	60
Plant height (cm)								
IGC ï 9901	75.61	79.65	85.90	88.67	103.84	103.93	88.45	90.75
IGC ï 9902	80.00	82.75	91.27	92.00	99.33	105.87	90.20	93.54
IGC ï 9903	81.12	84.69	93.45	95.27	112.38	118.90	95.65	99.62
Mean	78.91	82.36	90.21	91.98	105.18	109.6	91.43	94.64
Level of significance	G	F	H	G X F	G X H	F X H	G X F X H	
SEm±	1.40	1.40	1.61	1.49	1.51	1.42	1.55	
CD(P=0.05)	4.20	NS	4.63	4.38	4.44	4.17	4.56	
Number of tillers/plant								
IGC ï 9901	9.50	14.25	14.29	19.54	16.71	22.67	13.51	18.82
IGC ï 9902	10.89	16.10	15.75	21.00	16.26	21.73	14.32	19.61
IGC ï 9903	13.05	18.35	18.09	22.95	18.36	27.46	16.50	22.92
Mean	11.15	16.23	16.04	21.16	17.11	23.95	14.81	20.45
Level of significance	G	F	H	G X F	G X H	F X H	G X F X H	
SEm±	0.81	0.81	0.96	0.84	0.87	0.83	0.90	
CD(P=0.05)	2.38	NS	2.82	2.47	2.56	2.44	2.65	
Clump diameter (cm)								
IGC ï 9901	5.35	7.25	6.57	9.10	8.84	9.60	6.92	8.65
IGC ï 9902	6.14	8.33	7.65	10.27	8.71	10.50	7.50	9.70
IGC ï 9903	7.55	9.00	9.16	10.95	9.72	10.95	8.81	10.30
Mean	6.35	8.19	7.79	10.11	9.01	10.35	7.74	9.55
Level of significance	G	F	H	G X F	G X H	F X H	G X F X H	
SEm±	0.32	0.32	0.24	0.34	0.36	0.32	0.38	
CD(P=0.05)	NS	NS	0.71	1.00	NS	0.94	1.12	
Leaf stem ratio								
IGC ï 9901	0.75	0.82	0.81	0.85	0.90	0.97	0.82	0.88
IGC ï 9902	0.78	0.84	0.82	0.86	0.89	0.88	0.83	0.87
IGC ï 9903	0.80	0.90	0.87	0.95	0.97	0.94	0.88	0.93
Mean	0.78	0.85	0.83	0.89	0.92	0.93	0.84	0.89
Level of significance	G	F	H	G X F	G X H	F X H	G X F X H	
SEm±	0.02	0.02	0.03	0.03	0.03	0.03	0.03	
CD(P=0.05)	0.06	0.06	NS	0.09	0.09	NS	0.09	
Leaf area index								
IGC ï 9901	1.94	2.05	2.00	2.10	2.30	2.27	2.08	2.14
IGC ï 9902	2.00	2.10	2.08	2.15	2.22	2.23	2.10	2.16
IGC ï 9903	2.15	2.32	2.27	2.38	2.33	2.50	2.25	2.40
Mean	2.03	2.17	2.12	2.21	2.28	2.33	2.14	2.23
Level of significance	G	F	H	G X F	G X H	F X H	G X F X H	
SEm±	0.05	0.05	0.04	0.06	0.06	0.05	0.07	
CD(P=0.05)	0.15	0.15	NS	0.18	0.18	0.15	0.21	
Dry matter accumulation (kg/m^2)								
IGC ï 9901	0.29	0.36	0.33	0.36	0.37	0.46	0.32	0.38
IGC ï 9902	0.30	0.37	0.36	0.46	0.36	0.48	0.33	0.41
IGC ï 9903	0.30	0.40	0.35	0.48	0.37	0.51	0.34	0.45
Mean	0.30	0.39	0.35	0.40	0.37	0.49	0.33	0.41
Level of significance	G	F	H	G X F	G X H	F X H	G X F X H	
SEm±	0.01	0.01	0.02	0.02	0.02	0.02	0.03	
CD(P=0.05)	0.03	0.03	0.06	0.06	0.06	0.06	0.09	

G- Genotype, F- Fertility levels, H- Harvesting interval

Table 2. Effect of fertility levels and cutting interval on yield and quality of *Chrysopogon* genotypes (Pooled mean of 4 years)

Genotype	Fertility levels (kg/ha) / harvesting schedule (days)							
	Control		30 N + 20 P		60 N + 40 P		Mean	
	30	60	30	60	30	60	30	60
				Green fodder yield (t/ha)				
IGC ï 9901	13.35	14.02	15.07	16.91	17.25	18.42	15.06	16.45
IGC ï 9902	13.64	14.90	16.05	18.16	17.09	19.34	15.59	17.47
IGC ï 9903	13.89	15.24	16.28	18.46	17.67	19.86	15.95	17.85
Mean	13.62	14.72	15.80	17.67	17.17	19.20		
Level of significance	G	F	H	G X F	G X H	F X H	G X F X H	
SEm±	0.40	0.40	0.41	0.45	0.45	0.44	0.49	
CD(P=0.05)	1.18	1.18	1.21	1.32	1.32	1.29	1.44	
				Dry matter yield (t/ha)				
IGC ï 9901	2.92	3.55	3.31	3.64	3.69	4.62	3.28	3.94
IGC ï 9902	2.95	3.74	3.57	4.60	3.69	4.78	3.40	4.37
IGC ï 9903	3.00	4.08	3.49	4.88	3.73	5.06	3.40	4.67
Mean	2.96	3.82	3.46	4.41	3.77	4.85		
Level of significance	G	F	H	G X F	G X H	F X H	G X F X H	
SEm±	0.08	0.08	0.07	0.09	0.09	0.10	0.12	
CD(P=0.05)	0.23	0.23	0.21	0.26	0.26	0.29	0.35	
				Crude protein yield (t/ha)				
IGC ï 9901	0.16	0.19	0.18	0.20	0.22	0.26	0.19	0.22
IGC ï 9902	0.16	0.20	0.20	0.25	0.21	0.26	0.19	0.24
IGC ï 9903	0.18	0.25	0.22	0.29	0.24	0.31	0.21	0.28
Mean	0.16	0.20	0.19	0.24	0.22	0.27		
Level of significance	G	F	H	G X F	G X H	F X H	G X F X H	
SEm±	0.01	0.01	0.01	0.02	0.02	0.02	0.02	
CD(P=0.05)	0.03	0.03	0.03	0.06	0.06	0.06	0.06	
				Crude protein (%)				
IGC ï 9901	5.50	5.33	5.50	5.49	5.72	5.54	5.61	5.45
IGC ï 9902	5.45	5.37	5.74	5.53	5.81	5.65	5.61	5.52
IGC ï 9903	6.13	6.05	6.32	5.04	6.40	6.17	6.28	6.09
Mean	5.53	5.42	5.72	5.52	5.81	5.62		
Level of significance	G	F	H	G X F	G X H	F X H	G X F X H	
SEm±	0.02	0.02	0.03	0.03	0.03	0.03	0.03	
CD(P=0.05)	0.06	0.06	NS	0.09	0.09	NS	0.09	
				Neutral detergent fiber (%)				
IGC ï 9901	64.95	68.30	63.47	66.72	61.45	64.30	63.29	66.44
IGC ï 9902	63.84	67.15	62.95	65.55	60.23	62.50	62.34	65.07
IGC ï 9903	63.25	67.00	62.57	64.11	60.00	61.87	61.94	64.33
Mean	64.01	67.48	63.00	65.46	60.56	62.89		
Level of significance	G	F	H	G X F	G X H	F X H	G X F X H	
SEm±	0.05	0.05	0.04	0.06	0.06	0.05	0.07	
CD(P=0.05)	0.15	0.15	NS	0.18	0.18	0.15	0.21	
				Acid detergent fiber (%)				
IGC ï 9901	45.70	48.95	43.20	46.71	43.75	44.39	44.22	46.68
IGC ï 9902	44.19	48.05	42.35	45.50	42.90	43.75	43.15	45.77
IGC ï 9903	43.85	47.19	41.70	45.19	42.75	43.11	42.77	45.16
Mean	44.58	48.06	42.42	45.80	43.13	43.75		
Level of significance	G	F	H	G X F	G X H	F X H	G X F X H	
SEm±	0.01	0.01	0.02	0.02	0.02	0.02	0.03	
CD(P=0.05)	0.03	0.03	0.06	0.06	0.06	0.06	0.09	

G- Genotype, F- Fertility levels, H- Harvesting interval

Table 3. Physico-Chemical changes after four years in soil under the influence soil fertility levels and harvesting intervals to *Chrysopogon* genotypes

Treatments	pH	Organic carbon (%)	Electrical conductivity (mmhos/cm)	Available nutrients (kg/ha)			Bulk density (g/cc)	Infiltration rate (mm/hr)
				N	P	K		
Genotypes								
IGC-9901	7.2	0.37	0.32	160	10.2	235.5	1.51	1.50
IGC-9902	7.3	0.36	0.31	161	10.0	236.3	1.52	1.51
IGC-9903	7.3	0.38	0.33	162	10.0	232.7	1.51	1.50
Fertility levels (kg/ha)								
Control	7.3	0.34	0.34	148	10.0	230.5	1.55	1.50
30 N+20 P	7.3	0.38	0.33	172	11.8	234.0	1.53	1.53
60 N+40 P	7.4	0.40	0.32	175	12.0	235.0	1.54	1.54
Harvesting intervals (Days)								
30	7.3	0.35	0.33	167	11.7	236.0	1.54	1.56
60	7.2	0.37	0.33	170	11.6	234.7	1.52	1.54
Initial level	**7.4**	**0.36**	**0.34**	**165**	**11.5**	**242.0**	**1.60**	**1.45**

Change in soil fertility status

After four years of experimentation, physical and chemical analyses of soil indicated marginal changes over initial status (Table 3). Due to perennial grass based system, organic carbon was not much changed. However, pH and electrical conductivity reduced slightly from 7.4 to 7.2 and 0.34 to 0.31 mmhos/cm, respectively. *Chrysopogon* cover of the soil reduced available N, P and K; and bulk density slightly. However, infiltration rate was increased from 1.45 to 1.51 mm/hr, respectively. Supplementation of 60 N and 40 P kg/ha increased organic carbon up to 0.40 percent and available N from 165 to 175 and P from 11.5 to 12.0 over initial level. Lower level of N and P supplementation also positively influenced the fertility status over initial status. In the plots where N and P were not added, organic carbon and available nutrients were reduced remarkably. Available K status was reduced after four years as evident with reduction in available status. Due to cutting intervals, components of soil fertility except organic carbon were not much influenced. Bulk density and infiltration rate were slightly lower *i.e*. 1.52 g/cc and 1.54 mm/hr, respectively, with cutting interval of 60 days.

Conclusion

Thus considering the biomass yield, quality and physico-chemical properties of soil, *among Chrysopogon* genotypes, IGC ï 9903 fertilized with 60 kg N + 40 kg P_2O_5/ha harvested at 60 days interval can give highest forage production in semi arid situation of central India.

References

AOAC, 1995. *Official methods of analysis*, Vol. I, 15th Edn Washington, DC, USA: Association of Official Agricultural Chemists, Washington, DC, USA.

Bora, S. K. and K. Thakuria 2002. Effect of introduction of *Setaria sphacelata* and cutting management on productivity of a natural grassland. *Indian J. Agron.* 45: 827-830.

Chandra, A., R. Saxena, A. K. Roy and P. S. Pathak. 2004. Estimation of genetic variation in *Dichanthium* genotypes by RAPD technique. *Tropical Grasslands.* 38:245-252.

Dabadghao, P. M. and K. A. Shankarnarayan. 1973. *The grass covers of India*. Indian Council of Agricultural Research, New Delhi.

Dwivedi, G. K., K. C. Kanodia and P. Rai. 1980. Effect of nitrogen and phosphorus on quality and quantity of herbage of *Chrysopogon fulvus* cv. MHOW at Jhansi. *Forage Res.* 6: 181-186.

Fisher, A. R. 1950. *Statistical Methods for Research Workers*, Oliver and Boyd Ltd . Edinburgh.

Georing, H. K. and P. J. Vonsoest. 1970. *Forage Fiber Analysis*. USDA Agriculture Handbook No. 379 , Washington , D.C., USA.

Jain, A., A. K. Roy, P. Kaushal, D. R. Malaviya and S. N. Zadoo. 2003. principal component analysis in Guinea grass (*Panicum maximum* Jacq) germplasm *Indian J. Plant Genet. Resour.* 16: 32-35.

Kumar, S., A. K. Roy and S. A. Faruqui. 2007. Performance of promising genotypes of *Sehima nervosum* under the influence of fertility levels and cutting intervals in semiarid region. *Range Mgmt. & Agroforestry.* 28 (2): 375-76.

Misra, M. K. and B. N. Misra. 1982. Relationships of photosynthetic structure with biomass and energy content of a grassland community. *Indian J. Forestry*. 5: 111-115.

Niranjan, K. P., K. C. Kanodia, G. K. Dwivedi and P. Rai. 1990. Comparative study of fertilizer and legume on the forage production of *Chrysopogon fulvus* under rainfed conditions for promotion of biomass in Wastelands. *Range Mgmt. & Agroforestry.* 11: 21-24.

Roy, A. K. 2004. Genetic variability, character association and path analysis in black spear grass (*Heteropogon contortus* L.) *Range Mgmt. & Agroforestry* 25: 11-16.

Roy, A. K., D. K. Agarwal and S. Gupta. 1999. Character association in sen grass. *Range Mgmt. & Agroforestry* 20: 131-135.

Trivedi, B. K. 2001. Ecological management of *Iseilema* grassland for sustainable production. *Range Mgmt. & Agroforestry.* 22: 6 -19.