Forage Res., **48**(4) : pp. 530-533 (2023) **http://forageresearch.in**

HJ 1514 – A NEW SINGLE CUT HIGH BIOMASS FORAGE SORGHUM VARIETY FOR HARYANA

PUMMY KUMARI*, D. S. PHOGAT, SATYAWAN ARYA, S. K. PAHUJA, SATPAL, N. KHAROR, B. L. SHARMA, DALVINDER PAL SINGH, VINOD KUMAR AND SARITA DEVI

Forage Section, Department of Genetics & Plant Breeding
CCS Haryana Agricultural University, Hisar-125 004 (Haryana), India
**(e-mail : pummy.hau@gmail.com)*
(Received : 07 March 2023; Accepted : 30 March 2023)

SUMMARY

HJ 1514, a single-cut forage sorghum variety with improved yield and quality was developed by pedigree method in Forage Section, Department of Genetics & Plant Breeding, CCS Haryana Agricultural University, Hisar. It is released & notified for cultivation in *kharif* season for all sorghum growing areas of Haryana. HJ 1514 produced 664.2 q/ha green fodder yield (mean of three years) which is 15.0 % and 17.1 % more than the checks HJ 541 (577.7 q/ha) and HJ 513 (567.3 q/ha), respectively. Dry fodder yield of HJ 1514 was 160.5 q/ha which is 14.2 % and 19.2 % more than the checks HJ 541 (140.7 q/ha) and HJ 513 (134.8 q/ha), respectively. This variety produces good seed yield also *i.e*., 7.9 q/ha and responsive at 125% recommended dose of fertilizer (RDF). It has high total soluble solids (TSS) *i.e.* 9.0 % which is higher than both the checks HJ 541 (7.30 %) and HJ 513 (6.00%). It possesses 141.0 µg/g hydrocyanic acid (HCN) content which is less than permissible limit is 200 µg/g and crude protein (CP) was 8.37 percent and *In-vitro* dry matter digestibility (IVDMD) was 45.6 percent which are comparable to both checks. It is resistant against major foliar diseases and tolerant to shoofly and stem borer.

Key words : Forage sorghum, fodder, quality, tolerance

Forage sorghum is nutritive forage, highly palatable having good regeneration capability with high green fodder production and high dry matter digestibility as compared to other fodder crops of *summer* and *kharif* seasons especially of North India (Ghosh *et al.,* 2016). It is a multipurpose crop having 4F values food, forage, fodder, feed and many more industrial uses. Its primary center of origin is regions in Sudan, Ethiopia and West Africa and it spreads across different continents including North America, Africa, Asia, and Australia of the world with time. It belongs to family Poaceae and its genome size is 730 Mbp (approx.) (Paterson *et al*., 2009). It is an important climate resilient crop due to its ability to tolerate drought stress and staple food for the majority of the population of semi-arid tropics. It is grown worldwide in 38 million ha area approximately belonging to more than 86 countries with annual production of 58 million tonnes (FAO, 2018).

India is the world's highest livestock owner with 535.78 million populations (20th Livestock-Census). This shortage will further continue to exist because area under forage crops is stagnant for last 2-3 decades and livestock population is increasing in country. Livestock security of any country mainly depends on the availability of quality green and dry fodder. Abrupt climate changes affects the livestock sustainability all over the world resulting in decline in production and quality of fodder and feed crop which in turn affects the animal growth and milk production adversely (Nardone *et al.,* 2010). ICAR- IGFRI, Jhansi 2022 reported that there is deficit of 11.24, 23.4 and 28.9 per cent green fodder, dry fodder and concentrates, respectively, in the country."

For the success of any dairy industry supply of nutritious fodder is a pre-requisite. For seed production government agencies and NGOs could play a crucial role. The major constraint for low production and productivity of fodder crops in the country is the lack of improved varieties/hybrids and non-availability of quality seed. Absence of improved genotype, weed control, plant protection, fertilizer and irrigation resulted in 39, 33, 31, 30 and 22 per cent losses, respectively, in the productivity of fodder sorghum as compared to full package of practices (Satpal *et al*., 2021). This study revealed that an improved, location

specific variety played a critical role in full package of practices.

Keeping this in consideration Forage Section, Department of Genetics & Plant Breeding, CCS Haryana Agricultural University is continuously doing efforts since 1970 to develop improved varieties/hybrids of important forage crops for North India. The improved single-cut forage sorghum variety HJ 1514, was released and notified vide Gazette Notification, Ministry of Agriculture & Farmers Welfare under Department of Agriculture, Cooperation and Farmers Welfare, GOI, New Delhi, vide **S.O.E. No. 1056(E), Dated 06.03.2023** for cultivation in Haryana under timely sown, normal fertility and irrigated conditions in *kharif* season. The new variety was registered with NBPGR having IC No. 645447. The new variety HJ 1514 was developed in the Forage Section, Department of Genetics & Plant Breeding, CCS Haryana Agricultural University, Hisar by pedigree method of breeding from cross the SGL 87 x HJ 513-15-10-11-4 (**SGL 87:** Sweet, tall having high green and dry fodder yield with good quality and **HJ 513:** Tan type, non-sweet, tall, high green and dry fodder yield, good quality, tolerant to stem borer and shoot fly) as given in Fig. 1.

Fodder yield performance of HJ 1514

Green fodder yield of this variety is 664.2 q/ha (mean of three years) which is 15.0 % and 17.1 % more than the checks HJ 541 (577.7 q/ha) and HJ 513 (567.3 q/ha), respectively in station trials (Table 1). Similarly, dry fodder yield was 160.5 q/ha (mean of three years) which is 14.2 % and 19.2 % more than the checks HJ 541 (140.7 q/ha) and HJ 513 (134.8 q/ha), respectively in station trials (Table 2). It is also good seed yielder variety with seed yield of 7.9 q/ha which is 8.2% and 14.4 % more than the checks HJ 541 (7.3 q/ha) and HJ 513 (6.9 q/ha), respectively in station trials (Table 3). Field view of HJ 1514 is shown in Fig. 2. For getting maximum green fodder yield and better quality like high crude protein percent and *in vitro* dry matter digestibility crop should be harvested at the time of 50 percent flowering (approx. 80 days after sowing).

TABLE 1
Comparative performance of HJ 1514 for green fodder yield (q/ha) against checks (HJ 541 & HJ 513) in Station Varietal Trials in Haryana from *Kharif* 2018 to *kharif* 2020

Year	Location	HJ 1514 (SH 1514)	HJ 541 (Check)	HJ 513 (Check)	CD (p=0.05)	CV (%)
Kharif 2018	Hisar	697.1	585.4	563.4	35.2	15.2
Kharif 2019	Hisar	654.3	571.3	567.3	41.7	21.3
Kharif 2020	Hisar	641.3	576.3	571.3	56.9	16.3
Overall Mean		664.2	577.7	567.3	-	-
% increase over checks		-	15.0	17.1	-	-

TABLE 2
Comparative performance of HJ 1514 for dry fodder yield (q/ha) against checks (HJ 541 & HJ 513) in Station Varietal Trials in Haryana from kharif 2018 to kharif 2020

Year	Location	HJ 1514 (SH 1514)	HJ 541	HJ 513	CD (p=0.05)	CV (%)
Kharif 2018	Hisar	169.0	143.2	128.4	26.2	16.3
Kharif 2019	Hisar	160.3	139.7	137.3	23.4	19.1
Kharif 2020	Hisar	152.3	139.1	138.6	21.9	15.4
Overall Mean		160.5	140.7	134.8	-	-
% increase over checks		-	14.2	19.2	-	-

TABLE 3
Comparative performance of HJ 1514 for seed yield (q/ha) against checks (HJ 541 & HJ 513) in Station Varietal Trials in Haryana

Year	Location	HJ 1514 (SH 1514)	HJ 541	HJ 513	CD (p=0.05)	CV(%)
Kharif 2020	Hisar	7.9	7.3	6.9	1.9	6.6
% increase over checks		-	8.2	14.4	-	-

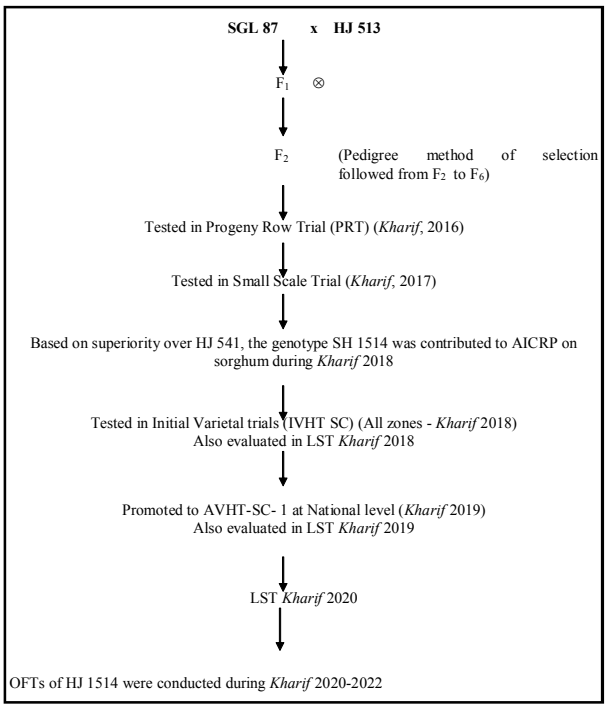

Fig. 1. Pedigree of forage sorghum variety HJ 1514.

Fig. 2. Field view of HJ 1514 (SH 1514).

Quality attributes of HJ 1514

As far as fodder quality of HJ 1514 is concerned it has high total soluble solids (TSS%) *i.e* 9.00 % which is higher than both the checks HJ 541 (7.30 %) and HJ 513 (6.00%). HCN content of this variety is 141.0 µg/g which is far less than permissible limit of 200 µg/g (on fresh wt. basis). Crude protein percent is 8.37 percent and *In-vitro* dry matter digestibility (IVDMD) is 45.6 percent which ise comparable to both checks (Table 4).

Performance against major foliar diseases and insect pests

It is tolerant to major insect pests like shoot fly and stem borer. The variety HJ 1514 recorded 16.1% shoot fly dead hearts which is at par with checks HJ 541 and HJ 513 with 19.2 % and 20.2 % shootfly dead hearts, respectively. The stem borer dead hearts were recorded 14.1%, which is at par with checks HJ 541 and HJ 513 with 17.25 % and 17.6 %, respectively. This variety is resistant against major foliar diseases *viz.,* grey leaf spot, zonate leaf spot, sooty stripe, anthracnose and leaf blight (Table 4).

TABLE 4
Performance of HJ 1514 (SH 1514) for morphological traits in Station Varietal Trials in Haryana *kharif* 2020

Traits	HJ 1514 (SH 1514)	Checks	
		HJ 541	HJ 513
Plant height (cm)	315.60	288.60	291.30
No. of leaves/plant	17.30	15.60	16.30
Leaf Length (cm)	82.30	80.30	81.70
Leaf Breadth (cm)	8.10	8.30	7.70
Stem Girth (mm)	15.70	15.90	14.90
Leaf /Stem Ratio	0.31	0.29	0.23

TABLE 5
Performance of HJ 1514 (SH 1514) for quality parameters, insect pest infestation and disease resistance in Station Varietal Trials in Haryana

Characteristics	HJ 1514 (SH 1514)	HJ 541	HJ 513
HCN (µg/g)	141.0	33.0	-
TSS %	9.00	7.30	6.00
Crude protein %	8.37	8.78	7.37
IVDMD%	45.6	49.9	48.7
Shoot fly dead hearts (%)	16.1	19.2	20.2
Stem borer deadhearts (%)	14.1	17.25	17.6
Zonate leaf spot	1.3	1.3	1.9
Sooty stripe	1.6	1.6	1.9
Grey Leaf spot	2.0	2.0	2.0

TABLE 6
Adaptability to agronomic variables for green fodder yield during *kharif* 2019 under Haryana Conditions

Fertilizer levels		Green fodder yield (q/ha)			
		HJ 1514 (SH 1514)	National Check 1 CSV 21F	State Check 1 HJ 541	State Check 2 HJ 513
75% RDF (F1)		470.2	445.0	453.6	432.1
100% RDF (F2)		534.3	469.8	465.5	457.6
125% RDF (F3)		570.0	496.2	518.3	502.4
Percentage gain	i) F_1	-	5.66	3.66	8.82
or loss under	ii) F_2	-	13.73	14.78	16.76
other doses	iii) F_3	-	14.87	9.97	13.46

TABLE 7
Net return and B:C ratio of HJ 1514 at different fertility levels

Variety	Net Return (Rs./ha)	B : C ratio	Net Return (Rs./ha)	B : C ratio	Net Return (Rs./ha)	B : C ratio
	75% RDF		100% RDF		125% RDF	
SH 1514	23666	1.67	31287	1.88	35361	1.99
CSV 21F	20511	1.58	23222	1.66	26135	1.73
HJ 541	21583	1.62	22686	1.64	28903	1.81
HJ 513	18904	1.54	21704	1.61	26909	1.75

Agronomy and Economics

The single-cut forage sorghum variety, HJ 1514 released and notified for cultivation in all sorghum growing areas of Haryana under timely sown, normal fertility level and irrigated conditions in *kharif* season (from 25 June to 10 July). Data presented in Table 5 & 6 reveal that HJ 1514 has shown 14.87, 9.97 and 13.46 per cent increase for green fodder yield over CSV 21F (national check), HJ 541 (state varietal check) and HJ 513 respectively at F_3 fertility level *i.e.* 125% RDF. This variety HJ 1514 has shown 11.27 percent increase in green fodder yield over the state varietal check HJ 541 in the on-farm trials (OFTs) conducted during *kharif* 2020-22.

CONCLUSION

The new variety HJ 1514 exhibited 15.0 % and 17.1 % superiority over the best check varieties HJ 541 and HJ 513 for green fodder yield. It is a good single cut forage sorghum variety having high green and dry fodder yield with low hydrocyanic acid content and high TSS percent with tolerance against shoot fly, stem borer and resistant against major foliar diseases.

REFERENCES

Anonymous 2019 : 20th Livestock Census, 2019. *http://dahd.nic.in/about-us/divisions/statistics.*

FAO. 2018 : Web:http://www.fao.org/faostat/en/data / QC.

Ghosh, P.K., D.R. Palsaniya and R. Srinivasan, 2016 : Forage research in India: Issues and strategies. *Agric. Res. J.,* **53**(1): 1-12.

Nardone, A., B. Ronchi, N. Lacetera, M.S. Ranieri and U. Bernabucci, 2010 : Effects of climate changes on animal production and sustainability of livestock systems. *Livestock Sci.,* **130**(1-3): 57-69.

Paterson, A., J. Bowers, R. Bruggmann et al., 2009 : The Sorghum bicolor genome and the diversification of grasses. *Nature,* **457** : 551-556. *https://doi.org/10.1038/nature07723.*

Satpal, S. Kumar, A. Kumar, B. Gangaiah, K.K. Bhardwaj and Neelam, 2021: Evaluation of energy efficiency and optimum resource management in forage sorghum [*Sorghum bicolor* (L.) Moench] under semi-arid tropics. *Forage Res.,* **47**(3): 308-312.