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HFO 806: A NEW HIGH YIELDING SINGLE-CUT OAT VARIETY FOR SOUTH & HILL ZONE OF INDIA

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SUMMARY

The new single-cut oat variety, HFO 806, developed by CCS Haryana Agricultural University, Hisar was released and notified for cultivation under timely sown, normal fertility and irrigated conditions in the *rabi* season of South (Telangana, Tamil Nadu, Karnataka, Kerala and Andhra Pradesh) and Hill (Himachal Pradesh, UT of Jammu and Kashmir) zone of the country. It was developed through pedigree method of breeding. The variety HFO 806 gave 376.4 q/ha green fodder yield which was 22.5% more than the national check Kent (307.3 q/ha) and 21.4% higher than the best national check OS 6 (310.0 q/ha) and 1.9% superior than the zonal check OS 403 (369.5 q/ha) in South zone, whereas it gave 295.2 q/ha green fodder yield which is 6.4% more than the national check OS 6 (277.5 q/ha) and 5.0% higher than the best national check Kent (281.2 q/ha) and 1.7% superior than the zonal check SKO 96 (290.2 q/ha) in Hill zone of the country. In case of dry matter yield, the variety HFO 806 (83.9 q/ha) exhibited superiority over the national check Kent (65.9 q/ha) by 27.3%, the best national check OS 6 (66.9 q/ha) by 25.4% and almost at par with the zonal check OS 403 (82.6 q/ha) and the best qualifying variety JO-06-23 (85.3 q/ha) in South zone, also the variety HFO 806 (71.6 q/ha) exhibited superiority over the national check OS 6 (67.9 q/ha) by 5.4% and the best national check Kent (68.8 q/ha) by 4.1% and almost at par with the zonal check SKO 96 (72.1 q/ha) and the best qualifying variety SKO 241 (72.8 q/ha) in Hill zone of the country. In South Zone, variety HFO 806 (9.5 q/ha) was almost at par with the national check OS 6 (9.9 q/ha) for seed yield (q/ha). But in Hill Zone, variety HFO 806 (23.9 q/ha) was 25.1% superior to the national check Kent (19.1 q/ha) and 23.2% superior to the best national check OS 6 (19.4 q/ha) and almost at par with the best qualifying variety RO-11-1-2 (23.2 q/ha) for seed yield (q/ha). The variety HFO 806 was almost at par with the national checks Kent and OS 6 for crude protein (%) in South Zone whereas it exhibited superiority over national check Kent by 4.96% and was almost at par with the best national check OS 6 for crude protein (%) in Hill Zone. Furthermore, it showed moderate resistance to powdery mildew disease in the Hill Zone.

Key words: Oat, single cut, green fodder, seed yield, crude protein, resistance

Animals were always an integral part of agriculture for building up of sound rural economy in India which make momentous contribution in terms of various dairy products and act as a major driving force for carrying out farm operations. Generally, livestock is not only the major source of cash income for marginal farmers but also provide insurance against crop failure. There is 4.8 percent increase in livestock population (514.11 million) in India compared to Livestock Census-2012 Also there is 1.3 percent increase of total bovine population comprising of buffalo, cattle and Yak which was 303.8 million in 2019 compared to previous census (Anonymous, 2022). Despite India have 200 million cattle and 92 million buffalo, milk productivity is much lower than average for the world. India has a net scarcity of 35.6 percent green fodder, 11 percent dry agricultural left overs and 44 percent feeds according to the IGFRI Vision-2050 report. The productivity of fodder has to be increased in order to meet the increasing demand for quality fodder. The nutritive composition of fodder is controlling factor that decide the productivity and

TABLE 1A
Green fodder yield (q/ha): Mean performance in the South Zone over three years

Year	No. of locations	Mean Performance of proposed variety HFO 806	National checks		Zonal check	SZ Qualifying Varieties					
			Kent	OS 6	OS 403	OL1874-1	OL1876-1	RO-11-1-2	RO-11-1-3	JO-06-23	SKO-241
1st Year 2018-19 (IVTO (SC)	4	381.2	332.4	333.7	384.5	442.2	377.2	387.6	335.8	444.3	168.5
2nd Year 2019-20 (AVTO (SC-1)	4	398.5	312.2	294.8	409.2	350.3	390.5	367.1	335.7	362.3	356.9
3rd Year 2020-21 AVTO (SC-2)	4	349.4	277.4	301.4	314.8	310.6	316.0	315.5	309.7	299.2	346.6
Weighted Mean		376.4	307.3	310.0*	369.5*	367.7	361.2	356.7	327.1	368.6*	290.7
Overall % superiority			22.5	21.4	1.9	2.4	4.2	5.5	15.1	2.1	29.5

*=Indicates the best check/best qualifying variety
IVTO (SC): Initial Varietal Trial in Oats (SC); AVTO (SC-1): First Advanced Varietal Trials in oats (SC); AVTO (SC-2): Second Advanced Varietal Trials in oats (SC).

TABLE 1B
Green fodder yield (q/ha): Mean performance in the Hill Zone over three years

Year	No. of locations	Mean Performance of proposed variety HFO 806	National checks		Zonal check	HZ Qualifying Varieties					
			Kent	OS 6	SKO-96	OL1874-1	OL1876-1	RO-11-1-2	RO-11-1-3	JO-06-23	SKO-241
1st Year 2018-19 (IVTO (SC)	3	304.3	262.9	271.9	281.7	299.8	260.6	293.3	303.1	286.4	293.1
2nd Year 2019-20 (AVTO (SC-1)	3	330.5	325.1	302.1	337.4	298.0	321.0	293.9	314.4	314.8	305.6
3rd Year 2020-21 AVTO (SC-2)	3	250.8	255.7	258.6	251.4	245.6	247.1	272.6	262.2	265.4	254.8
Weighted Mean		295.2	281.2*	277.5	290.2*	281.1	276.2	286.6	293.2*	288.9	284.5
Overall % superiority			5.0	6.4	1.7	5.0	6.9	3.0	0.7	2.2	3.8

*=Indicates the best check/best qualifying variety
IVTO (SC): Initial Varietal Trial in Oats (SC); AVTO (SC-1): First Advanced Varietal Trials in oats (SC); AVTO (SC-2): Second Advanced Varietal Trials in oats (SC)

TABLE 2A
Dry Matter Yield (q/ha): Mean performance in the South Zone over three years

Year	No. of locations	Mean Performance of proposed variety HFO 806	National checks		Zonal check	SZ Qualifying Varieties					
			Kent	OS 6	OS 403	OL1874-1	OL1876-1	RO-11-1-2	RO-11-1-3	JO-06-23	SKO-241
1st Year 2018-19 (IVTO (SC)	4	84.1	68.9	68.3	88.1	101.2	74.0	78.8	68.0	106.2	47.8
2nd Year 2019-20 (AVTO (SC-1)	4	88.9	67.2	65.0	89.4	74.3	86.2	77.9	75.4	84.4	78.0
3rd Year 2020-21 AVTO (SC-2)	4	78.6	61.6	67.4	70.3	68.4	68.0	70.2	67.2	65.4	78.3
Weighted Mean		83.9	65.9	66.9*	82.6*	81.3	76.1	75.6	70.2	85.3*	68.3
Overall % superiority			27.3	25.4	1.6	3.2	10.2	11.0	19.5	-1.6	22.8

*=Indicates the best check/best qualifying variety
IVTO (SC): Initial Varietal Trial in Oats (SC); AVTO (SC-1): First Advanced Varietal Trials in oats (SC); AVTO (SC-2): Second Advanced Varietal Trials in oats (SC).

TABLE 2B
Dry Matter Yield (q/ha): Mean performance in the Hill Zone over three years

Year	No. of locations	Mean Performance of proposed variety HFO 806	National checks		Zonal check	HZ Qualifying Varieties					
			Kent	OS 6	SKO-96	OL1874-1	OL1876-1	RO-11-1-2	RO-11-1-3	JO-06-23	SKO-241
1st Year 2018-19 (IVTO (SC)	3	63.0	58.0	60.6	64.1	61.2	57.1	66.9	67.3	61.7	70.6
2nd Year 2019-20 (AVTO (SC-1)	2	100.0	94.4	88.2	97.5	88.1	88.0	81.4	93.2	86.9	88.7
3rd Year 2020-21 AVTO (SC-2)	2	56.0	59.5	58.6	57.9	59.0	56.3	64.1	58.4	57.1	60.3
Weighted Mean		71.6	68.8*	67.9	72.1*	68.2	65.7	70.2	72.1	67.6	72.8*
Overall % superiority			4.1	5.4	-0.7	5.0	9.0	2.0	-0.7	5.9	-1.6

*=Indicates the best check/best qualifying variety
IVTO (SC): Initial Varietal Trial in Oats (SC); AVTO (SC-1): First Advanced Varietal Trials in oats (SC); AVTO (SC-2): Second Advanced Varietal Trials in oats (SC).

TABLE 3A
Location wise performance of proposed variety HFO 806 for seed yield (q/ha) against other entries and checks in the South Zone during 2020-21

Year	No. of locations	Mean Performance of proposed variety HFO 806	National checks		Zonal check	SZ Qualifying Varieties					
			Kent	OS 6	OS 403	OL1874-1	OL1876-1	RO-11-1-2	RO-11-1-3	JO-06-23	SKO-241
3rd Year 2020-21 AVTO (SC-2)	3	9.5	10.8*	9.9	11.5*	11.1	10.1	11.3*	11.2	10.6	10.0
% superiority			-12.0	-4.0	-17.4	-14.4	-5.9	-15.9	-15.2	-10.4	-5.0

AVTO (SC-2): Second Advanced Varietal Trials in oats (Single-Cut)-seed.

TABLE 3B
Location wise performance of proposed variety HFO 806 for seed yield (q/ha) against other entries and checks in the Hill Zone during 2020-21

Year	No. of locations	Mean Performance of proposed variety HFO 806	National checks		Zonal check	HZ Qualifying Varieties					
			Kent	OS 6	SKO-96	OL1874-1	OL1876-1	RO-11-1-2	RO-11-1-3	JO-06-23	SKO-241
3rd Year 2020-21 AVTO (SC-2)	2	23.9	19.1	19.4*	25.8*	17.2	17.6	23.2*	18.1	22.5	22.7
% superiority			25.1	23.2	-7.4	39.0	35.8	3.0	32.0	6.2	5.3

AVTO (SC-2): Second Advanced Varietal Trials in oats (Single-Cut)-seed.

TABLE 4A
Crude protein (%): Mean performance in the South Zone over three years

Year	No. of locations	Mean Performance of proposed variety HFO 806	National checks		Zonal check	SZ Qualifying Varieties					
			Kent	OS 6	OS 403	OL1874-1	OL1876-1	RO-11-1-2	RO-11-1-3	JO-06-23	SKO-241
1st Year 2018-19 (IVTO (SC)	3	8.2	8.7	7.6	9.4	7.7	8.7	5.8	9.5	8.8	11.3
2nd Year 2019-20 (AVTO (SC-1)	3	7.4	7.1	9.2	7.9	8.4	8.4	7.5	8.8	7.8	8.1
3rd Year 2020-21 AVTO (SC-2)	3	8.5	7.8	8.0	9.6	9.1	8.2	9.6	7.8	7.2	9.3
Weighted Mean		8.03	7.87	8.27*	8.97	8.40	8.43	7.63	8.70	7.93	9.57
% superiority			2.12	-2.82	-10.41	-4.37	-4.74	5.24	-7.66	1.26	-16.03

*=Indicates the best check/best qualifying variety
IVTO (SC): Initial Varietal Trial in Oats (SC); AVTO (SC-1): First Advanced Varietal Trials in oats (SC); AVTO (SC-2): Second Advanced Varietal Trials in oats (SC).

TABLE 4B
Crude protein (%): Mean performance in the Hill Zone over three years

Year	No. of locations	Mean Performance of proposed variety HFO 806	National checks		Zonal check	HZ Qualifying Varieties					
			Kent	OS 6	SKO-96	OL1874-1	OL1876-1	RO-11-1-2	RO-11-1-3	JO-06-23	SKO-241
1st Year 2018-19 (IVTO (SC)	1	9.0	8.8	9.3	9.6	8.8	10.2	8.8	8.5	9.9	8.5
2nd Year 2019-20 (AVTO (SC-1)	2	9.9	9.1	9.4	9.8	10.5	9.8	10	10.4	8.9	9.1
3rd Year 2020-21 AVTO (SC-2)	1	9.3	9.3	9.9	10.8	10.5	10.2	10.2	8.2	11.4	10.2
Weighted Mean		9.53	9.08	9.50*	10.00*	10.08*	10.00	9.75	9.38	9.78	9.23
% superiority			4.96	0.26	-4.75	-5.46	-4.75	-2.31	1.60	-2.56	3.25

*=Indicates the best check/best qualifying variety.
IVTO (SC): Initial Varietal Trial in Oats (SC); AVTO (SC-1): First Advanced Varietal Trials in oats (SC); AVTO (SC-2): Second Advanced Varietal Trials in oats (SC).

overall performance of livestock. The gap between demand and supply may be tapering down by increasing the productivity per unit area and time or identifying fodder oat varieties of desired traits like quick growing, drought tolerance, high yield potential and fertilizer & irrigation responsive which will adapt better under changing climatic scenario. Oat is a short period (60-70 days) fast growing palatable fodder crop which produces significant amount of green fodder having better nutritional quality (Phogat *et al.,* 2021). Increasing human population has left us with very limited resources for fodder cultivation as there is massive pressure on cultivated land and water assets which is needed for fulfilling high demand for food. Furthermore, the quality of fodder used in livestock feeding is most important, as it decide not only the productivity but also the milk and dairy products quality. Fodder quality is determined by several factors like variety, crop genetic constitution, time of harvesting, climatic factors and different biotic & abiotic stresses. Identification of location specific high yielding varieties with better nutritional quality is the prerequisite for higher productivity of livestock population as about 80-90 percent of their nutrient requirement is met from the fodder crops.

Varieties having improved yield potential that can also be cultivated at higher elevations compared to the current climatic restrictions for arable agriculture could alleviate some of the overgrazing pressures and demolition of forests. There is hardly any oat breeding program where the principal objective is developing fodder oat, and very diminutive work is in progress to develop genotypes for cultivation in the cool and high altitude areas (Kumar *et al.,* 2023). The available oats varieties are losing their yield potential with passage of time due to assorted climatic conditions and they are prone to damage by different biotic and abiotic stresses. Therefore, there is an ominous need to release varieties having better yield potential, nutritive value, resistance to biotic and abiotic stresses and ability to cope up with changing climate scenario. The new oats variety 'HFO 806' is high yielding, and insect pest and diseases resistant. This paper has summaries on its development.

The single-cut oat variety, 'HFO 806' was developed by Forage Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar. It was released by the Central Sub-committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops & notified by Ministry of Agriculture & Farmers Welfare,

TABLE 5
Disease-pest tolerance in AVTO (SC)-2 (Seed) trial during 2020-21 in Hill zone

Entries	Palampur	
	Powdery mildew severity (%)	Reaction
OL-1874-1	39	S
Kent (NC)	28	S
OL-1876-1	29	S
RO-11-1-3	36	S
JO-06-23	32	S
SKO-241	34	S
KO-96 (ZC-HZ)	37	S
OS-6 (NC)	27	S
RO-11-1-2	29	S
HFO-806	24	MR

(Department of Agriculture, Co-operation and Farmer's welfare) vide notification number **S.O. 4065(E), dated 31st August, 2022** for timely sown, normal fertility and irrigated conditions in the *rabi* season of South (Telangana, Tamil Nadu, Karnataka, Kerala and Andhra Pradesh) and Hill (Himachal Pradesh, UT of Jammu and Kashmir) zone of the country. This variety has been registered with NBPGR having national identity number **IC 641847**. It was developed through pedigree method of breeding. The variety HFO 806 gave 376.4 q/ha green fodder yield which is 22.5% more than the national check Kent (307.3 q/ha) and 21.4% higher than the best national check OS 6 (310.0 q/ha) and 1.9% superior than the zonal check OS 403 (369.5 q/ha) in South zone, whereas gave 295.2 q/ha green fodder yield which is 6.4% more than the national check OS 6 (277.5 q/ha) and 5.0% higher than the best national check Kent (281.2 q/ha) and 1.7% superior than the zonal check SKO 96 (290.2 q/ha) in Hill zone of the country (Table 1 A & B). In case of dry matter yield, the variety HFO 806 (83.9 q/ha) exhibited superiority over the national check Kent (65.9 q/ha) by 27.3%, the best national check OS 6 (66.9 q/ha) by 25.4% and was almost at par with the zonal check OS 403 (82.6 q/ha) and the best qualifying variety JO-06-23 (85.3 q/ha) in South zone, also the variety HFO 806 (71.6 q/ha) exhibited superiority over the national check OS 6 (67.9 q/ha) by 5.4% and the best national check Kent (68.8 q/ha) by 4.1% and almost at par with the zonal check SKO 96 (72.1 q/ha) and the best qualifying variety SKO 241 (72.8 q/ha) in Hill zone of the country (Table 2 A & B). In South Zone, variety HFO 806 (9.5 q/ha) was almost at par with the national check OS 6 (9.9 q/ha) for seed yield (q/ha). But in Hill Zone, variety HFO

806 (23.9 q/ha) was 25.1% superior to the national check Kent (19.1 q/ha) and 23.2% higher than the best national check OS 6 (19.4 q/ha) and almost at par with the best qualifying variety RO-11-1-2 (23.2 q/ha) for seed yield (q/ha) (Table 3 A & B). It is good in nutritional quality as well. The variety HFO 806 was almost at par with the national checks Kent and OS 6 for crude protein (%) in South Zone. This variety exhibited superiority over national check Kent (4.96%) and was almost at par with the best national check OS 6 for crude protein (%) in Hill Zone (Table 4 A & B). It showed moderate resistance against powdery mildew disease (Table 5).

CONCLUSION

HFO 806 is a single-cut variety of oat having higher potential for green and dry fodder yield, good nutritional quality and moderately resistance against powdery mildew disease. It possesses all the features of a good fodder yielder along with improved nutritional quality. Hence, it is expected that this variety will boost the fodder production and animal output in South and Hill Zones of the country.

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