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Oats (*Avena sativa*):

A potential winter fodder crop for better livestock production

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Oat is a multipurpose, popular, nutritionally rich cereal crop used globally for food, feed, and fodder. In India, fodder oats cover approximately 0.25 million hectares of area, with the maximum acreage in Uttar Pradesh (34%), followed by Punjab (20%), Bihar (16%), Haryana (9%), and Madhya Pradesh (6%). Its cultivation area has now extended to the eastern regions due to better adaptability, nutritional superiority and excellent feed and fodder values. It is a unique crop being cultivated as single cut, multicut and dual purpose and best suited in cool-season climates. The fodder yield can be enhanced significantly by adopting recently released high yielding varieties and better agronomic management practices, viz. seed rate and sowing time, water, weed and nutrient management.

Keywords: Cultural practices, Disease management, Fodder oats, Nutritional quality, Varietal diversity

FOR centuries, oats (*Avena sativa* L.) have been an integral part of livestock farming, valued for their exceptional nutritional benefits and adaptability. Farmers worldwide rely on oats to provide high-quality fodder for cattle, sheep, and horses, ensuring healthy growth, sustained milk production, and overall well-being. The secret behind the popularity of oats as a fodder crop lies in their rich quality composition. Packed with energy, fiber, and protein, oats offer a balanced diet that meets the nutritional needs of livestock. Fodder oats are less likely to cause digestive disorders, making them a safe and reliable choice for animal feed. The quality of oat fodder largely depends on how and when it is harvested. Farmers carefully monitor their crops, knowing that timing is crucial. When harvested early, in the flowering or milk stage, oats retain their maximum nutritional value, ensuring optimal digestibility for animals. They can be fed as green forage, providing fresh nutrients, or preserved as silage and hay for use during seasons when fresh fodder is scarce. Beyond their nutritional advantages, oats play a vital role in supporting healthy digestion in ruminants. Their high fiber content promotes gut health, while their carbohydrate-rich composition provides the necessary energy for growth and productivity. This makes oats a preferred fodder choice, especially in regions where livestock farming is a crucial part of agriculture. Their versatility, ease of cultivation, and remarkable health benefits make them an indispensable resource for farmers and a vital component of a well-balanced diet for animals.

Nutritional quality

Oats are considered high-quality fodder due to their balanced nutritional profile, making them an excellent choice for livestock. Although oats contain moderate protein levels (10–12%), which is lower than that of legumes

Field view of oat crop

Oat inflorescence

like alfalfa, their protein is more digestible than that of many grasses. Oats also offer a balanced fiber content (10–15%), promoting healthy digestion and preventing gastrointestinal issues, while their digestibility ensures efficient nutrient extraction. They contain essential minerals like calcium, phosphorus, and potassium, although not in as high quantities as legumes, and complement the diet when fed alongside other forages. Oats are highly palatable to most livestock, encouraging increased feed intake, and are highly digestible, mainly when harvested at the optimal stage. These qualities make oats a valuable and versatile fodder, providing a good mix of energy, protein, and fibre. Among cereals, oat grain and fodder have high nutritional values and considered one of the best fodder crop for livestock productivity.

Climatic suitability

The success of oat cultivation is heavily influenced by climate conditions, making it essential for farmers to understand the specific climate requirements to optimise yield and quality. Oats thrive in cool-season climates with temperatures ranging from 7–24°C. They are well suited for early spring and late fall planting and can tolerate light frosts. However, extreme heat during the growing season can negatively affect development and yield, so selecting the optimal planting time based on local temperature patterns is crucial. As long-day plants, oats require longer daylight hours for optimal growth and grain formation. Regions with consistent day length are more favourable for their cultivation. Oats have relatively low water requirements compared to other cereal crops, making them ideal for areas with moderate rainfall. The optimal annual rainfall for oats ranges from 500–1000 mm. They can also tolerate drier conditions, which makes them suitable for semi-arid regions. Ensuring proper soil moisture during critical growth stages, such as germination and heading, is essential for a successful harvest.

Soil and tillage

Oats are adaptable to a range of soil types but thrive best in well-drained soils with a slightly acidic to neutral *p*H, ideally between 6.0–7.0. Sandy loam and loam soils are particularly well suited for oat cultivation. To prepare the soil, two to three passes with a harrow or cultivator, followed by planking, are typically sufficient to control weeds and achieve the desired soil structure.

Seed rate and sowing time

For successful oat cultivation, a seed rate of 80–100 kg/ha is recommended to ensure a uniform stand. To protect the seeds from fungal and pathogenic diseases, they should be treated with Captan or Thiram at a rate of 3 g/kg before sowing. The optimal time for sowing oats is from the second fortnight of October. It is essential to maintain a row spacing of 25–30 cm and sow the seeds at a depth of 3–4 cm. The drilling method, specifically using a zero-tillage drill, is the preferred method for sowing to achieve efficient seed placement and good soil contact.

Varietal diversity

In India, more than 70 varieties have been developed in fodder oats in three categories including, (i) Single cut (harvested at 50% flowering stage), (ii) Dual (suitable for fodder with a cut at 40–45 days after sowing and grains harvested at maturity), and (iii) Multicut (first cut at 50–55 days, followed by two subsequent cuts at 30–35 days

Table 1. Fodder nutritional profile of oats (dry matter basis)

Composition	Minimum	Maximum	Mean
Dry matter (%)	10.80	26.60	16.56
Crude protein (%)	6.55	10.52	7.8
Ash%	6.60	11.20	8.17
Acid detergent fiber (%)	42.15	47.40	45.12
Neutral detergent fiber (%)	61.97	67.25	63.25
In vitro dry matter digestibility (%)	30.2	51.7	48.21
Acid detergent lignin	6.00	15.30	8.88
Hemi cellulose (%)	23.60	33.30	28.19
Fe content (ppm)	139.03	617.39	203.2
Zn content (ppm)	17.91	66.74	25.92
Ca content (ppm)	3444.07	6092.32	4352.65
Cu content (ppm)	4.44	7.08	4.89
S content (ppm)	1716.90	3031.89	2375.12

Source: ICAR-IGFRI, Jhansi

intervals). The major institutions engaged in oat breeding include Chaudhary Charan Singh Haryana Agricultural University, Hisar; Punjab Agricultural University, Ludhiana; Mahatma Phule Krishi Vidyapeeth, Rahuri; Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur; Jawaharlal Nehru Krishi Vishva Vidyalaya, Jabalpur; Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar; and ICAR-Indian Grassland and Fodder Research Institute, Jhansi. Oats are cultivated in various regions with different varieties, each offering distinct characteristics suited to specific environmental and agricultural conditions. The number of varieties in the seed chain has increased over the years; however, old varieties (Kent, UPO-212, JHO-822, OS-6, JHO-851, and HJ-8) notified before 2000 are still in the seed chain, contributing considerably to breeder seed demand and production. These varieties differ in their growth habits, fodder yields, disease resistance, and adaptability to different climates, making them valuable choices for both fodder and seed production. Each variety is developed to maximize yield, nutritional value, and resilience to various stresses, catering to the needs of farmers and livestock.

Cropping system

Oats are commonly incorporated into fodder-based crop rotations across almost all cropping zones.

Seeds of oat

Table 2. List of fodder oat varieties developed in the last five years for different agro-climatic zones of India (*Source*: Chand *et al.* 2025)

Variety	Nature	Identification year	Parent institute	Area of adoption
OL 1869-1	Single cut	2019	PAU, Ludhiana	Rajasthan, Haryana, Punjab, Terai region of Uttarakhand, Uttar Pradesh, Maharashtra, Gujarat, Madhya Pradesh and Chhattisgarh
HFO 607	Single cut	2019	CCS HAU, Hisar	Rajasthan, Haryana, Punjab, Terai region of Uttarakhand and Western Uttar Pradesh
OL 1861	Single cut	2019	PAU, Ludhiana	Punjab, Haryana, Rajasthan, Assam, Manipur, Bihar, Jharkhand, Odisha, Uttar Pradesh, Madhya Pradesh, Gujarat, Maharashtra, Tamil Nadu, Karnataka, and Andhra Pradesh
HFO 529	Single cut	2020	CCS HAU, Hisar	Himachal Pradesh and UT of Jammu and Kashmir
OL 1896	Single cut	2020	PAU, Ludhiana	Rajasthan, Haryana, Punjab, Terai part of Uttarakhand
OL 1874-1	Single cut	2020	PAU, Ludhiana	Telangana, Tamil Nadu, Karnataka, Kerala and Andhra Pradesh
HFO 806	Single cut	2021	CCS HAU, Hisar	Himachal Pradesh, UT of J&K, Telangana, Tamil Nadu, Karnataka, Kerala and Andhra Pradesh
HFO 906	Single cut	2022	CCS HAU, Hisar	Rajasthan, Haryana, Punjab and Terai part of Uttarakhand
HFO 1014	Single cut	2023	CCS HAU, Hisar	Punjab, Haryana, Rajasthan, plain parts of Uttarakhand, Assam, Odisha, Bihar, Jharkhand and Eastern Uttar Pradesh
HFO 917	Single cut	2023	CCS HAU, Hisar	Punjab, Haryana, Rajasthan, plain parts of Uttarakhand, Assam, Odisha, Bihar, Jharkhand and Eastern Uttar Pradesh
SKO 244	Single cut	2023	SKUAST, Srinagar	Punjab, Haryana, Rajasthan, plain parts of Uttarakhand, Himachal Pradesh and UT of Jammu & Kashmir
OL 1874	Multi cut	2020	PAU, Ludhiana	Rajasthan, Haryana, Punjab, and Terai part of Uttarakhand
JO 05-304	Multi cut	2020	JNKVV, Jabalpur	Uttar Pradesh, Madhya Pradesh, Maharashtra, and Gujarat
HFO 707	Multi cut	2021	CCS HAU, Hisar	Terai part of Uttarakhand, Punjab, Haryana, and Rajasthan
PLP 24	Multi cut	2022	CSK HPKV, Palampur	Himachal Pradesh, Uttarakhand and UT of Jammu and Kashmir
HFO 915	Multi cut	2023	CCS HAU, Hisar	Himachal Pradesh and UT of Jammu and Kashmir
OL 1949	Multi cut	2023	PAU, Ludhiana	Himachal Pradesh and UT of Jammu and Kashmir
HFO 611	Dual type	2020	CCS HAU, Hisar	Rajasthan, Haryana, Punjab, and Terai part of Uttarakhand
OL 1876-2	Dual type	2020	PAU, Ludhiana	Assam, Odisha, Jharkhand and eastern UP
JO 10-506	Dual type	2020	JNKVV, Jabalpur	Assam, Odisha, Jharkhand and eastern UP
JO 13-513	Dual type	2023	JNKVV, Jabalpur	Punjab, Haryana, Rajasthan, plain parts of Uttarakhand, Assam, Odisha, Bihar, Jharkhand and Eastern Uttar Pradesh
OL 1931	Dual type	2023	PAU, Ludhiana	Assam, Odisha, Bihar, Jharkhand and Eastern Uttar Pradesh

The typical and beneficial crop sequences involving oats include sorghum + cowpea, followed by oat; sorghum followed by oat + berseem; and a rotation of maize + cowpea, followed by oats, and then maize + cowpea again. Another standard rotation involves sorghum followed by oat (multicut). These sequences help in improving soil fertility, enhancing fodder production, and supporting sustainable agricultural practices.

Nutrient management

The crop should be well manured with 15 tonnes of farmyard manure (FYM) per hectare, applied 20–30 days before sowing. For two-cut and multicut varieties, the recommended nutrient application is 120 kg of nitrogen (N), 40 kg of phosphorus (P_2O_5) per hectare for two cuts, and 180 kg of nitrogen, 60 kg of phosphorus, and 40 kg of potassium (K_2O) per hectare for multicut varieties. For single- and two-cut varieties, apply 80 kg of nitrogen and 40 kg of phosphorus per hectare as a basal dose. The remaining nitrogen should be applied at a rate of 40 kg/ha after the first cut. For multicut varieties, use 100–120 kg of nitrogen, 40 kg of phosphorus, and 40 kg of potassium per hectare at the basal stage of growth. The remaining nitrogen should be applied at a rate of 40 kg/ha after each cut, according to the cutting schedule followed for the respective varieties.

Water management

Oats require 4–5 irrigation, including a pre-sowing irrigation. If the soil is dry, irrigation should be applied before preparing the seedbed. The following irrigation should be given 20–25 days after sowing. Regular irrigation promotes tillering and enhances crop productivity, resulting in higher yields of green forage. For multicut varieties, a total of 7–8 irrigations is recommended throughout the growing season.

Weed management

Oats are infested with winter-season grassy and broad-leaved weeds, primarily found in wheat. Effective control of weeds in oats can be obtained with weeder-cum-mulcher at 4 week crop stage followed by application of 2,4-D @0.37 kg a.i./ha at 6 weeks crop stage.

Disease and insect management

Fodder yield and quality parameters are greatly affected by disease and pest incidences. Climatic conditions and the date of sowing significantly influence the severity of the biotic stresses. The major diseases and insects affecting oats are leaf blight (*Drechslera avenae*), powdery mildew (*Blumeria graminis* f. spp. *avenae*), and Bird cherry aphid (*Rhopalosiphum maidis*). Leaf blight can be managed by growing tolerant varieties (OS-6, UPO-94, JO-03-91, and JO-03-93) and treating seeds with carbendazim @2 g/kg seed, followed by foliar application of propiconazole @1 mL/L after 21 days of sowing. For powdery mildew, a spray of hexaconazole @0.05% and propiconazole @0.05% is recommended at 15-day intervals starting from disease onset. Aphids can be controlled by spraying plain water @400 L/ha and applying Malathion @0.05% in the patches of aphid colony.

Harvesting and yield

The proper stage of harvesting plays a crucial role in determining both the fodder yield and quality of oats. For single-cut oat varieties, harvesting should be done at 50% flowering. In double-cut varieties, the first cut is taken at 60 days, followed by the second cut at 50% flowering. For multicut varieties, the first cut is recommended at 50–55 days, with subsequent cuttings at 30-day intervals. The average green fodder yield for single, double, and multicut oat varieties ranges from 40–45, 45–55, and 50–65 tonnes/ha, respectively. For seed production, the timing of the last cut is critical and can vary depending on crop growth and weather conditions. A seed yield of 2–3 t/ha can be achieved if the crop is properly managed.

SUMMARY

Oat is a highly nutritious and adaptable crop, primarily grown for its green fodder, which is widely used in animal feed. It thrive in cool, temperate climates with temperatures ranging from 7–24°C and are best suited for soils with a slightly acidic to neutral *p*H. It can be grown in various soil types, with sandy loam and loam being ideal, provided they are well drained. The crop is typically grown in fodder-based rotations, often in conjunction with sorghum, maize, or berseem, and is crucial for maintaining soil fertility and supporting sustainable agricultural practices.

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