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SEWAN GRASS: AN IMPORTANT GRASS IN ARID REGIONS OF RAJASTHAN

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ABSTRACT

Sewan grass (Lasiurusscindicus), a well-known pastoral plant in the arid region of Rajasthan, is receiving some much-needed attention as mechanisation, modern agriculture, and unlawful grazing pose serious hazards to biodiversity conservation in arid and semi-arid environments. It is primarily found in wastelands, dunes, hammocks, arid, sandy plains, but is less frequently grown in farmer's fields. Sewan grass has a variety of qualities that make it a successful candidate for feed in dry regions, including high digestibility and palatability, soil binding, high temperature tolerance, strong nutritional content, and high digestibility and palatability. The percentage of their tissue that can be digested by ruminants varies, but it contains considerable amounts of crude fibre, lignin, minerals, and crude protein. Information on breeding techniques and seed manufacturing technology is also lacking. In order to help manage sewan grass both now and in the future, we have included a thorough discussion of agronomic management, breeding, and seed production strategies here.

INDRODUCTION

The Thar Desert in India is a 32 million hectares hot and dry desert. The scorching Desert occupies 85% of India and the remaining 15% of Pakistan. It is primarily found in the Indian states of Rajasthan, Gujarat, Punjab, Haryana, Karnataka, and Andhra Pradesh, and it symbolises the world's most inhospitable dry region. About 61 percent of Rajasthan's land area, or about 91 percent of the Indian desert, is located there. Rajasthan is bordered to the northeast by the semi-arid Aravali Hills, while to the west is the Great Indian Desert, or "Thar."

The principal characteristics of the Thar Desert are high wind speeds, enormous dunes, dunes that are stabilised in various ways, including semi-stabilized and stabilised dunes, high diurnal temperature variation, scarce and little rainfall, intense solar radiation, and a high rate of evaporation. Natural grasslands in desert regions are in a severely degraded state and produce only 300–400 kg/ha/year. With the exception of the Aravalli hills in the south, subtropical, dry, and semiarid regions including the northern part of Gujarat, the entire state of Rajasthan, western Uttar Pradesh, Punjab, Haryana, and Delhi are known for their dichanthium-Cenchrus-Lasiurus type grasslands. The principal perennial grass species of such grasslands are buffel-grass (*Cenchrusciliaris*), birdwood grass (*Cenchrussetigerus*), marvel grass (*Dichanthiumannulatum*), khavi grass (*Cymbopogonjawarancusa*), bermuda grass (*Cynodondactylon*), wire grass (*Eleusinecompressa*), sewan grass (Lasiurusscindicus), pan dropseed (Sporobolusmarginatus), tantia (*Dactylocteniumsindicum*), halfa grass (*Desmostachyabipinnata*) etc. (Bhagmal*et al*, 2011). The "King of Desert grasses" refers to the prominent perennial grass, locally known as sewan grass. Sewan grass, a member of the Poaceae family, is a native of arid regions of North Africa, the Sudanese and Sahelian regions, East Africa, and Asia. It is quite resistant to drought and arid weather, although in the early phases of development, it should be shielded from the wind.

Sewan grass is a C4 desert grass with a thick, hairy inflorescence, several branches, and a sturdy woody rhizome that can be found in arid wastelands. Although *Lasiurushirsutus*, the wild form of Sewan grass, is a diploid species with somatic chromosome number (2x) 20, several species of grass are quite variable in terms of chromosome numbers and polyploidy nature as well. Sewan grass is a perennial grass with a 20-year lifespan. Because it can be grown with vegetative propagation material like root slips, fertilisation is not required. In sandy deserts, sewan grass grows in bushy thickets that are used as grazing, hay, and cattle food.

Compared to other grasses including wonder grass, buffel grass, birdwood grass, and bermuda grass, sewan grass contains more calcium and lignin. Cellulose, lignin, and hemicellulose make up crude fibre. Sewan grass has lower nutritional value than other grasses, but it is nevertheless beneficial for small ruminants like sheep and goats due to its drought resistance ability to grow in conditions with very little rainfall (less than 250 mm).

DISTRIBUTION

Sewan grasslands are mostly found in dryland regions around the world, including parts of Africa, Asia, South America, and Europe that are arid or semi-arid. Ruminants graze sewan grass primarily, typically in conjunction with *Cenchrusciliaris* and *Cenchrussetigerus*, which share the same agro-ecological niche, particularly in Rajasthan and Pakistan (Khan et al.,1999,Bhati& Mruthyunjaya.1983, Gupta& Joshi.1984). In India, sewan grass can be found in western Rajasthan, Uttar Pradesh, Haryana, Punjab, some areas of Delhi, and Gujarat.

This area totals about 0.1 million hectares. In 18–28 sub-zones in western Rajasthan, the sewan is the species that is most suited to the area and most common. The primary distribution zone in the western Rajasthan state of India extends from the districts of Barmer and Bikaner to the west of Jodhpur. The huge sewan grasslands are also supported by the hummocky sandy plains of Bikaner and Barmer or nearby areas. Up to the previous ten years, Nachana, West Puggal, accounted for nearly 80% of the Jaisalmer district's overall geographic area. The sewan grasslands were supported by Mohangarh, Sultana, and Binjewala. The districts of Sriganganagar and Hanumangarh are appropriate for an agri-silvi-pasture system, with the sewan as a particular preference.

Botany

A perennial grass with a lifespan of up to 20 years is sewan grass (*Lasiurusscindicus*Henrard). It is a bushy, multi-branched desert grass with upright, climbing wiry stems that can reach heights of 1-1.6 m with a substantial woody rhizome (FAO, 2010). A slender leaf blade alternates with the leaves. The inflorescence is a silky raceme that is 10 cm long and has spikelets with hairs. Caryopsis is the name of the fruit (FAO, 2010; Burkill, 1985).

Climatic conditions in Sewan Grasslands

Rainfall

The region's agricultural production is mostly impacted by the substantial interannual variance in rainfall. In the dry region of Rajasthan, the average annual rainfall ranged from 100 to 400 mm, with a 40–70% coefficient of variance. The rainy season accounts for over 90% of all precipitation. Perennial grasses are crucial to the survival of a large population of cattle in these areas as well as the rural community's economy. The natural sewan grass is primarily found in regions with annual precipitation between 100 and 300 mm. On the interdunal plains, the rainfed cropping zone makes up the majority of the sewan growing area (more than 80%).

Temperature

The desert is synonymous with temperature extremes that range from 5.7°C in the winter to 48°C in the summer. The mean maximum temperatures ranging from 24 to 26°C. The coldest month is January, with mean low temperatures ranging from 6.5 to 9.5°C. The mean maximum temperature throughout the summer varies from 36.1°C in the east to 38°C in the west.

Drought

In India's drought-affected states, desert regions experience droughts far more frequently and intensely than other areas. Rajasthan is the most critical state in the nation with the highest possibilities of drought occurrence and rainfall deficits out of the 13 states that have been consistently designated as drought-prone. The effects of repeated droughts are less dangerous than those caused by three or four years of straight drought (1984–1987). Consecutive droughts have a very negative impact on the production of new fodder in Sewan, which causes animal death. The sewan could thrive under extremely arid and severe drought circumstances with less than 250 mm of yearly rainfall, according to experiments done at CAZRI in Jodhpur. It has also been observed that the probability of experiencing severe droughts affecting the grass production in a rainfall zone below 200 mm is about 50 per cent. Sewan being a promising desert grass provides sustained forage production for a longer period even under the harsh climate or lean period of arid regions of western Rajasthan.

Cropping system

Sewan has been found to be more suitable for wind strip cropping as an associated component of silvi-pasture system in the areas of sand dunes and undulations of sandy undulating aggraded alluvial, interdunal plains, and sandy undulating buried piedmonts. In Rajasthan as a whole, fourteen major landforms have been identified, with deposited sandy undulating plains being found to be more suitable for sewan grass coverage and growth.

Production technology

The perennial character of sewan grass (which can flourish for up to 15 to 20 years after sowing) sets it apart from other arable crops cultivated in the rainfed conditions of western Rajasthan. The grass develops over the course of two to three years before producing at its peak. Sewan grass is typically grown on non-cultivable wastelands that are classified as class VIII of land use capability. Adopting methods to save soil moisture is one of the most important instruments available to lessen the effects of drought and moisture shortage.

Measures	Remarks
Construction of contour furrows	60 cm wide x 25 cm deep and distance of 10–15 macross the slope.

	Increases the fodder production up to 130 per cent.
Inter row water harvesting (IRWH) system	The field's soil moisture status is improved by alternating 30 cm wide raised ditches with 70 cm wide raised beds. The forage was boosted by 66 percent above the standard planting strategy by seeds that were sown along the ditch edges.
Intercultural operations after 20–30 days of sowing	The field's soil moisture status is improved by alternating 30 cm wide raised ditches with 70 cm wide raised beds. The forage was boosted by 66 percent above the standard planting strategy by seeds that were sown along the ditch edges.

Seed production technology

The issue of producing high-quality grass seed presents a challenge for breeders and agronomists. The main barrier to pasture development is the availability of insufficient, poor-quality seed. The demand for tropical range grasses and legumes in our country is about 3000 t/year, whereas the supply is only about 450 t/year, resulting in a very huge supply-demand mismatch. The generation of grass seed is accompanied by numerous issues. The development of high yielding grass types has received very little attention. Additionally, it has been noted that the kinds that produce a lot of feed produce very little seed. Due to its perennial nature and propensity to form tussocks, maintaining the purity of the seed is also challenging. In sewan grass, the seed maturation is not synchronised.The production of seeds is susceptible to unfavourable weather, such as windstorms, rain, drought, etc. High wind speeds have been observed to cause mature seeds to fall to the ground, where they are then frequently destroyed by heavy rain. Low seed production occurs when drought or moisture shortages occur. In these conditions, the potential for seed production and its investigation are quite limited, which limits the farmers' ability to spread the use of sewan seed. Release sewan grass cultivars in accordance with the Indian Minimum Seed Certification requirements (IMSCS), field and seed requirements for identification.

Seed collection

Different methods have been applied to collect sewan grass seed with less effort:

1.Cutting or collecting occurs after the top 25% of the spike is fully mature, together with the spike's stem, or when 75% of the spike is fully mature and has dried for a couple of days. The germination rate of the seeds harvested using these techniques is satisfactory at 35–40%.

2. CAZRI, Jodhpur also developed a modified process in which the caryopses of the spikes are collected by hand-cutting the spike heads at the ideal moment. Additionally, using the conventional approach, seeds were manually gathered according to maturity. The findings showed that while the mean seed germination rate for the harvests in October and November was comparable using both approaches, it was nearly twice as high for the crop in March. Germination, however, was more prevalent in the conventional manner of seed harvest.

3. Manually removed from the ground in forest areas, seed has a very low germination probability as a result of ant damage. Quality seed with good germination can be obtained by hand collection according to seed maturity.

Principles for sewan grass seed production

The location must have all the agro-ecological qualities necessary for the management, growth, and development of a grass stand. If a drought strikes when seeds are forming, irrigation that can save lives should be made available to ensure the generation of high-quality seeds. The sowing techniques, fertiliser application, and other procedures must be carried out in accordance with the suggestions made in the grass production table. With the exception of December and January's cold temperatures, good quality seed could be produced when circumstances were watered. In order to prevent seed loss from rainfall, grass should be picked during the active wet season. If cuttings were made in July through August, there will be abundant tillering and increased inflorescence production starting in September.

Package & Practices	**Description**
Environmental features	
Soil	Sewan grass performs well on alluvial sandy plains, low dunes, hummocks and light textured soils with pH 8.5.

Climate	The climate of sewan-dominated zone has low and erratic rainfall (below 250 mm) and hightemperatures. arid to semi-arid climate.

Agronomic practices	
Land preparation	At the initial stage of growth of grass requires ploughing is essential to make field weed free.
Varieties	Mostly landraces are dominated in the pasturelands and forest areas of western Rajasthan, Central Arid Zone Research Institute (CAZRI), Jodhpur and its research centers have taken a lead to developed sewan grass varieties. Varieties *viz.* CAZRI Sewan-1 (CAZRI 30–5), JaisalmeriSewan (RLSB 11–50), CAZRI 317 and CAZRI 319 have been released.
Sowing	Test weight of sewan grass is 7 g, which make as the seeds vulnerable to winds. Therefore, care should be taken for better placement of seed. Generally, two methods are recommended for sowing:-
a) Furrow sowing	This approach involves mixing seeds with damp sandy soil in 1:5 ratios such that roughly 10–12 seeds should be ready for sowing after one crunch of the mixer. To prevent the immediate loss of soil moisture from the furrows and to protect the seed from ants and other biotic agents (Yadav 1991, Yadava&Beniwal. 2000), furrows were opened with the aid of a tractor or an Indian plough, and mixtures were drilled in 2-3 cm of soil at intervals of 75 to 100 cm. *L. scindicus*and *C. ciliaris* produce more when they intercrop than when they are grown separately. The improvement and growth of pastures and rangelands will

	benefit more from this system.
b) Pellets sowing	This technique can be used for both dry sowing and wet sowing to avoid grass seed loss on windy days as well as from birds and ants. Pallets created by adding a specific ratio of 100–125 g seed: 3500 g clay, 250 g FYM, 250 g sand, and the desired amount of water, dried for 24 hours in the shade with a manual chazlla or a straightforward rotating pellet maker created by CAZRI, Jodhpur. Pellets should be 0.5 cm in diameter and contain two to three seeds.
Irrigation management	Sewan is typically managed on rainfed, natural rangelands, with the monsoon season serving as its primary growing season. It is thought that irrigating sewan will reduce the productivity of the grass and shorten its lifespan from 10 to 5 years. The experiment carried out at CAZRI in Jodhpur, however, has demonstrated that light watering by sprinklers combined with nitrogen supplementation has boosted yields. As compared to *C. ciliaris*and *C. setigerus, L. scindicus*had the highest water and energy use efficiency.
Weed management	Especially in the early phases of growth and development, weeds compete with grass seedlings. Therefore, the early

	removal of weeds is crucial for the effective use of the soil's moisture and nutrients by grasses. Although hand weeding is more expensive than chemical weeding, it has been found to be more successful. Chemical weeding is not recommended because the grasses are valuable as fodder. It has been demonstrated that two manual weeding with a hoe after 20 days has been successful and profitable.
Harvesting	At maturity, the nutritional status of fodder is lowest, while total dry matter is higher. Therefore, following flowering, the green stage of the fodder crops should be picked to preserve their nutritional value.Utilising a mechanised harvester, the grass can be harvested and stored unchaffed in cubes. The grass is typically harvested with a sickle and chaffed by a chaffing machine after drying.
Productivity	Due to perennial nature, increase in age of the clumps increase green forage yield (15–17 q/ha).
Yield	A well-managed sewan grass with a healthy plant population can produce 20–25 kg/ha of seed and 35–40 q/ha of dry feed. With an output potential of roughly 250 kg/ha per year, it is quite high (CAZRI, 1990).

Breeding efforts and achievments for sawan grass

Plant breeding is the process of using two fundamental principlescreating variety and selectionto improve the genetic make-up of crop species. Sewan grass is cross-pollinated, thus there are already naturally existing varieties. Since sewan grass is utilised as fodder, the economically significant complex or super characteristic is forage yield. Direct selection cannot be extremely effective for yields in and of itself. Understanding the link between component qualities and complex personalities requires the study of interrelationships. Except for maturity and anthesis traits in arid regions, a generally positive association between yield and component traits is advantageous for crops. However, it is still advisable to break linkage drag between traits, which was made possible by a variety of population improvement strategies, such as recurrent selection and its modifications, Disruptive selection mating and Marker-assisted recurrent selection, genomic selection, and genome editing techniques, among others. Recurrent selection method and its adaptations are becoming increasingly used in sewan grass today for population growth and varietal development have been screened for yield and its component traits on a large number of accessions of sewan grass, and it was discovered that tillers number and dry matter yield are the characters showing the most variation, and green fodder yield showed a strong, positive correlation with spike length and tillers.

CONCLUSIONS

Sewan grass is not widely used in farmer's fields for a variety of reasons, including its rarity (high temperature), modernization of agriculture, cultivation of economically significant crops, research that is limited to an agronomic perspective, lack of R&D, the low weight of the seeds, highly variable environmental conditions (sandstorms), lack of awareness and education, overgrazing, lower profitability than economically significant crops, and uneven pod settin. Therefore, policies must encourage the growth of these traditional agroforestry systems in order to satisfy both current and future demands. Sewan grass possesses a number of desirable traits, including drought tolerance, C4 grass, and associations with advantageous bacterial colonies, but scientific organisations continue to ignore it. As a result, these characteristics can be used to improve germplasm, and as was already noted, intercropping sewan with other crops, trees, or shrubs also helps to minimise soil erosion and preserve soil fertility. To preserve the sewan grass germplasm and help farmers make additional cash for their living, sewan grass fodder needs to be made more widely available. Large increases in animal productivity are possible if fodder quality could be improved, particularly by adding additional high yielding kinds that are nutrient-dense. In conclusion, using the knowledge learned from model systems like Brachypodium and setaria with the information collected from the research effort to develop grain crops offers a good future view for improving the nutritional quality and productivity for forage crops.

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