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A Review on Siwan Grass (Lasiurus scindicus) found in Arid Environments

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Abstract

In particular, the Thar Desert in India is used in this review to highlight the significant function of Siwan grass (Lasiurus scindicus) in dry conditions. In order to deal with difficult temperatures and significant biotic pressure, it examines the ecological and economical advantages of agroforestry. Due to their ecological and practical benefits, indigenous plants are encouraged to be used in landscaping because of their capacity to adapt to dry environments. It also offers a thorough review of the vegetation of the Thar Desert, taking into account geology, climate, and interactions between people and plants. The article also explores the genetic diversity, phytochemical profile, and salt stress tolerance of Siwan grass. In conclusion, it emphasises the importance of grass in tackling climatic issues and resource constraints.

Keyword: Siwan grass, Desert, Arid, Environment, Agroforestry etc

Introduction

Agroforestry balances ecological and socio-economic needs, combining trees, shrubs, and crops. Nitrogen-fixing legumes improve soil fertility in the harsh Thar Desert. Economic benefits, water, and biodiversity protection are vital. (1) Native dry vegetation is well-suited for circular cultivation in extreme climates, adapting to harsh conditions and preserving biodiversity in dry area landscaping, offering food and aesthetic value with low water needs. Using native plants for dry landscapes is ecologically and economically sensible. (2)

Tropical thorn forests thrive in India's arid region, marked by limited vegetation due to harsh conditions. This article presents an in-depth look at the region's flora, focusing on tree species and aspects like geography, climate, and human interaction. (3)

India's desert regions, spanning 32 million hectares, endure resource challenges due to low rainfall, extreme temperatures, and salinity. Crops like pearl millet and desert shrubs support pastoralism in this arid landscape. (4) Endemic Indian desert grasses, Pennisetum typhoides and Lasiurus sindicus, were studied for their unique photosynthetic traits, revealing intriguing CO_2-fixation patterns and aspartic acid decarboxylase activity. (5)

A comprehensive floristic study in the biodiverse Thar Desert documented 206 species, 157 genera, and 62 plant families, highlighting the prevalence of Fabaceae, Poaceae, and Asteraceae. Herbaceous plants dominated (60.10%), followed by shrubs, trees, and climbers. These findings contribute to the conservation and sustainable management of desert

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plant resources. (6) Xerophytes like Prosopis cineraria, Capparis deciduas, and others dominate the Great Indian Desert's flora. This study highlights diverse fauna across habitats, emphasizing the positive impact of canal water on desert wildlife. (7)

Sewan grass and buffelgrass root dispersion and soil-binding ability were compared in sandy soil. Buffelgrass had larger, more capable roots, while sewan grass penetrated deeper soil layers. (8)Agro-morphological traits of eleven Lasiurus scindicus accessions from Cholistanshowed variations, including plant height, tillers, inflorescence length, and leaf traits, with promising genotypes identified. (9) Agroforestry is crucial in India's desert, supplying essentials, protecting against droughts, and ensuring stable income. It combines agriculture and forestry to enhance crop development, stability, and socioeconomic impact. (10)

Sewan grass (Lasiurus sindicusHenr.) thrives in the Great Indian Desert. Genetic diversity was studied with ISSR and RAPD markers, showing regional clustering and marker effectiveness. Regional variation influenced clustering. (11) HPTLC is employed to analyze phytochemicals in desert plant Lasiurus scindicusHenrard. Effective stigmasterol measurement was achieved using validated methods, with highest concentrations during cold extraction with hexane and ethanol. (12)

A study assessed 30 sewan grass varieties for green fodder yield and related traits, revealing moderate variability in leaf length and green fodder production. Positive relationships were observed between different traits, emphasizing the potential for improved yields through selection. (13) Research assessed Cholistan Desert's eight perennial grass species as feed for ruminants. Grass types affected nutrient degradation, while ruminant type influenced degradation rate, highlighting the value of these desert grasses for nutrition. (14) Top 30 sewan grass accessions were evaluated for variability in green fodder production. Phenotypic traits like tillers, dry matter yield, and leaf-stem ratio exhibited high variation, indicating potential for improvement. The potential for simultaneous improvement was shown by the positive correlations between dry matter yield per plant and spike length, the quantity of tillers per plant. (15)

Yield Improvement

Grassland and rangeland ecosystems are crucial for livestock, livelihoods, and rural economies in India. This paper explores the challenges and potential advancements in enhancing rangeland grasses for improved yield, quality, and stress tolerance. The discussion includes topics like polyploidy, apomictic breeding, and biotechnological solutions, anticipating a new era in grass variety production for dry and semi-arid regions. (16)Arid regions suffer from low natural grass production, but native sewas grass helps prevent erosion. Research used hormones to enhance seed yield, resulting in increased tillers, spikes, and green leaf percentage, while lowering canopy temperature. Best results were seen with cyclocel 100 ppm and paclobutrazol 200 ppm treatments, improving grass seed output. (17)
A three-year field experiment on Sewan grass demonstrated that combining salicylic acid (100 ppm) seed soaking and thiourea (0.05%) foliar spray led to superior Sewan grass growth, including increased height, tillers, spike length, test weight, seed, and grass yields. Thiourea treatments also elevated crude protein, crude fiber, and total ash levels. (18) Harsh weather and poor soil quality threaten crop production and cattle food supply. Lasiurus sindicus, a perennial grass thriving in dry environments, provides valuable fodder despite limited seed availability and data on seed set and yield. (19) Optimizing sewan grass pastures in Rajasthan's hot desert climate through two Kharif seasons, nursery-raised seedlings yielded high green fodder, dry matter, and crude protein. Water-based seed sowing enhances soil fertility, making perennial pastures beneficial despite initial costs. (20)

Adaptability Potential

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Lasiurus scindicusHenrard, a drought-resistant plant in Rajasthan's arid region, showed reduced protein and membrane stability, increased malondialdehyde, and activated antioxidants in response to NaCl concentrations during germination. Proline accumulation increased with salt content, possibly enhancing salt tolerance. (21) Research examined the impact of NaCl on Lasiurus scindicusHenrard seedling development, chlorophyll stability, and sugar content. Higher NaCl concentrations reduced germination, growth, pigments, and chlorophyll stability but increased soluble sugars, possibly aiding salt stress adaptation. (22) The investigation evaluated the salt tolerance of sewan grass (Lasiurus scindicusHenr.) populations from Cholistan Desert. Adaptations in root length, leaf area, ion regulation, osmolyte accumulation, and water use efficiency were identified. (23)

During The research examined the impacts of temperature and salinity on Lasiurus scindicusHenr., revealing their effects on germination, growth, and physiological traits. The results highlight the adaptability of L. scindicus for arid land restoration. (24) The research assessed morpho-anatomical adaptation potential in 14 Lasiurus scindicus (Henr.) accessions from Cholistan desert. Notable ecophysiological differences were observed in certain accessions, recommending their inclusion in core collections for ecosystem restoration. Further experimentation is suggested to identify ecotypes resilient to environmental stresses and aid Cholistan rangeland restoration. (25)

Plants in dry areas often face persistent water stress, leading to morphological and physiological adaptations. Elevated free proline levels, a common response to water scarcity, were observed in 14 grass species, but well-adapted grasses exhibited minimal proline accumulation despite similar conditions. (26)

A Rajasthan study assessed 4 treatments (direct sowing, pelleting, polymer seed treatment, and polymer band placement) for sewan (Lasiurus scindicus) pasture establishment. Polymer band placement improved germination, polymer at 20 kg/ha increased water-holding and field capacity, and infiltration rate. The study targeted L. scindicus, soil improvement, and pasture establishment. (27) In the Thar Desert near Jodhpur, Lasiurus scindicusHenr. exhibited substantial dry matter production over four years (1990–1993) with variable rainfall (182–775 mm). With a Leaf Area Index of 133, it absorbed 33% to 54% of solar energy. Water usage efficiency was 13-20.8 kg DM ha-1 mm-1, with water consumption from 144 to 271 mm. RANGETEK model yield projections closely matched actual yields, deviating only +8% to 12%. (28)

Modern agriculture faces the challenges of population growth and climate change. Agroforestry is essential due to limited arable land, requiring restoration of India's 121 million hectares of degraded land. Water scarcity necessitates using unconventional sources like sewage. Livestock remains crucial, and diverse plant species can convert desert areas into productive fodder vegetation, offering environmental benefits. (29)

Research focused on Lasiurus scindicusHenrard, a drought-resistant grass in Pakistan. Various water holding capacities were used to replicate drought stress, revealing adaptations like reduced leaf size, thicker cuticles, and higher root lignification. Populations were ranked by drought tolerance as CH>TH>KK>CN, demonstrating that anatomical changes enhance L. scindicus' drought resistance. (30) Sewan grass, adapted to arid areas, struggles with limited seed production due to environmental factors. Hormone treatments positively impacted leaf water content, phenol, and sugar levels, enhancing seed production. (31)

In Bikaner, Rajasthan, nitrogen levels and row spacing were tested on sewan grass (Lasiurus sindicus). Tighter row spacing and 60 kg N/ha led to optimal yields and returns. (32) Interplanting legumes with fruit trees in western Rajasthan's desert ecosystem showed positive impacts on growth and productivity, with high water usage efficiency, supporting agri-horticultural systems. (33)

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Significance

The Thar Desert's unique ecosystem houses diverse life forms with survival traits for harsh conditions. Adapted species offer valuable genes for resilience, while traditional practices like agroforestry support sustainability against environmental challenges. (34) From 2013 to 2015, a survey in the Thar desert revealed 206 species across 62 families. Fabaceae, Poaceae, and Asteraceae were dominant. Herbaceous vegetation prevailed (60.10%), crucial for sustainable resource management in the region. (35)

Sewan grass (Lasiurus scindicus) is essential for arid ecosystems but faces challenges like mechanization and grazing. This review focuses on its underutilization, aiming to provide comprehensive information on breeding, seed production, and management. (36) Dromedary camels from various breeds grazed sewan pasture for 155 days. Pregnant camels supplemented with Phaseolus aconitifolius showed weight gain but later loss, with blood test variations and impacts on pasture yields and carrying capacity. Grazing affected soil nutrients, highlighting the need for supplemental feeding during slow pasture growth. (37)

Ten Rathi female calves were divided into two feeding groups: Group 1 (G1) received ad libitum sewan grass, while Group 2 (G2) received a combination of groundnut haulm and concentrate for 100 days. G2 exhibited higher weight gain, dry matter intake, and nutritional digestibility compared to G1, indicating the superior palatability and effectiveness of groundnut haulm-based feed for Rathi calves. (38)

Juvenile Bikaneri camels were given ad libitum sewan grass in the first phase for 30 days, followed by dry Ardu leaves at 1.0 kg/head/day for 30 days. The addition of Ardu leaves increased dry matter intake, digestibility, and nutrient content, while water usage also rose. Serum biochemical values remained mostly consistent, highlighting the positive impact of supplementing camel diets with tree leaves on nutrient uptake and development. (39) Sewan grass (Lasiurus sindicus) hay was investigated for Marwari stallions' nutrition, showing favorable nutrient ratios, high palatability, and satisfactory digestibility coefficients. It can be a primary roughage source for arid-region horses. (40)

In Phytoremediation

Phytoremediation is 10 times more cost-effective than traditional methods for soil cleanup. C4 tropical grasses together enhance benefits and efficiency, making them viable for pollution mitigation with notable case studies (41) Lasiurus sindicusHenrard, or Sewan grass, thrives in India's Thar Desert, showing potential for phytoremediation and restoration efforts amidst environmental challenges, involving local communities and experts. (42) Lasiurus scindicus demonstrated phytoremediation potential for lead-contaminated soil, accumulating significant lead levels in roots during a 105-day pot study, highlighting its effectiveness in detoxifying soil and water. (43)

Conclusion

The overview emphasises the importance of Siwan grass, or Lasiurus scindicus, in arid areas. Notwithstanding having the capability to be an vital pastoral plant that gives a ramification of advantages, along with fodder, soil binding, and resistance to intense environments, it's far underutilised and confronted with problems as a end result of factors like mechanisation, modernity, and grazing. Despite the fact that the feed price of the plant has been highlighted in research to some distance, there's a dearth of statistics on seed production and breeding. The thorough evaluate fills in this gap by using providing insights into Siwan grass control practises, thereby assisting within the sustainable use and conservation of this sizeable plant species in dry settings.

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Table- 01 Common Herbs reported in Arid Region

S.no.	Plant Botanical Name	Family	Common Name
1	Abutilon indicum	Malvaceae	Kanghi
2	Acalypha indica	Euphorbiaceae	Kuppi
3	Achyranthes aspera	Amaranthaceae	Modo kanto, Adhijhara,Katio
4	Acrachneracemosa	Poaceae	Chinki
5	Aervalanata	Amaranthaceae	Chhoti Bui
6	Aerva persica	Amaranthaceae	Safed Bui, Buari
7	Aervapseudotomentosa	Amaranthaceae	Bui
8	Ageratum conyzoides	Asteraceae	Visadodi
9	Aloe vera	Liliaceae	Patha
10	Amaranthus viridis	Amaranthaceae	Chaulie
11	Anisomeles indica	Lamiaceae	Ghabro
12	Argemone mexicana	Papaveraceae	Satyanashi
13	Aristida adscensionis	Poaceae	Lampro
14	Aristida funiculata	Poaceae	Lamp
15	Arnebiahispidissima	Boraginaceae	Rambus
16	Atylosiaplatycarpa	Fabaceae	SukliSengha

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17	Bacopa monnieri	Plantaginaceae	Brahmi
18	Barleriaprionitis	Acanthaceae	Bajradanti
19	Blepharis repens	Acanthaceae	Bhangari
20	Boerhaviadiffusa	Nyctaginaceae	Santhi, Punarnava
21	Borreria articularis	Rubiaceae	Poi, Safed bachla
22	Brachiariaramosa	Poaceae	Murat
23	Cassia italica	Fabaceae	Sonela
24	Cassia occidentalis	Fabaceae	Kesudo
25	Cassia tora	Caesalpinaceae	Phunwad
26	Celosia argentea	Amaranthaceae	Garkha, Imarti
27	Cenchrus biflorus	Poaceae	Bhurat
28	Cenchrus ciliaris	Poaceae	Dhaman
29	Cenchrus prieurii	Poaceae	Lambio-bhurat
30	Cenchrus setigerus	Poaceae	Bhurtio
31	Chenopodium album	Amaranthaceae	Chilaro
32	Chenopodium album	Chenopodiaceae	Bathua
33	Cistanchetubulosa	Orobanchaceae	Lonkiro mut
34	Cleome gynandra	Cleomaceae	Bagra
35	Cleome viscosa	Cleomaceae	Hulhul, Bagro
36	Commelinabenghalensis	Commelinaceae	Bakhana
37	Convolvulus deserti	Convolvulaceae	Hiranpagi,Shankhp ushpi
38	Corchorus depressus	Tiliaceae	Bahuphali, Cham-ghas
39	Corchorus trilocularis	Tiliaceae	Hade-ka-khet
40	Coronopusdidymus	Brassicaceae	Pitpapra
41	Cressacretica	Convolvulaceae	Rudanti
42	Crotalaria burhia	Fabaceae	Sanio, Jhunda, Chag
43	Crotalaria medicaginea	Fabaceae	Gungario
44	Cyamopsis tetragonoloba	Poaceae	Gwar
45	Cymbopogon jawarancusa	Poaceae	Buraro
46	Cynodondactylon	Poaceae	dubdi, dhob
47	Cyperus bulbosus	Cyperaceae	Moth, Motho
48	Cyperus rotundus	Cyperaceae	Chhab
49	Dactylocteniumaegyptium	Poaceae	Makaro, Manchi
50	Dactylocteniumsindicum	Poaceae	Tantia, ganthio
51	Dichanthiumannulatum	Poaceae	Karad

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52	Dicoma tomentosa	Asteraceae	Kantelo, Kantio
53	Digera muricata	Amaranthaceae	Lolaru
54	Digitariabicornis	Poaceae	Jheranio
55	Eclipta alba	Asteraceae	Jal Bhangro
56	Enicostemmaaxillare	Gentianaceae	Naame
57	Eragrostisciliaris	Poaceae	Lutio-lamp
58	Eragrostis minor	Poaceae	Poongyo
59	Eragrostistremula	Poaceae	Chuvalio
60	Eruca vesicaria	Brassicaceae	Tara-meera
61	Euphorbia granulata	Euphorbiaceae	Dudheli
62	Euphorbia hirta	Euphorbiaceae	Dudhi
63	Evolvulusalsinoides	Convolvulaceae	Phooli
64	Fagoniacretica	Zygophyllaceae	Dhamaso
65	Farsetiahemiltonii	Brassicaceae	Hiranchabbo
66	Gisekiapharnaceoides	Gisekiaceae	Morang, Sareli
67	Glinuslotoides	Molluginaceae	Jima, Bakada
68	Glossonemavarians	Apocynaceae	kheerdi, Dodha
69	Haloxylonsalicornicum	Chenopodiaceae	Khar, Lana
70	Heliotropiumcrispum	Boraginaceae	Kali bui
71	Heliotropiumsubulatum	Boraginaceae	Kali bui, Kharchan
72	Hydrilla verticillata	Hydrocharitaceae	Jhangi, Kureli
73	Indigofera cordifolia	Fabaceae	Bekar
74	Indigofera linifolia	Fabaceae	Lambio-bekario
75	Indigofera linnaei	Fabaceae	Bekario
76	Indigofera oblongifolia	Fabaceae	Goilia
77	Justicia simplex	Acanthaceae	Gungi-bunti
78	Lasiurus scindicus	Poaceae	Sewan
79	Launea nudicaulis	Asteraceae	Van gobhi
80	Launea procumbens	Asteraceae	Janleegobhi
81	Lepidaghathistrinervis	Acanthaceae	Aewalkangio
82	Lepidium sativum	Brassicaceae	Asaliyo
83	Leucas aspera	Lamiaceae	Dargal
84	Melilotus indica	Fabaceae	Marvo
85	Mollugocerviana	Molluginaceae	Chiria-ro-khet
86	Nelumbo nucifera	Nymphaceae	Kamal
87	Nymphaea pubescens	Nymphaceae	Be
88	Ochthochloacompressa	Poaceae	Ghoradhob
89	Oligochaeta ramosa	Asteraceae	Unt-kantilo
90	Oropetiumthomaeum	Poaceae	Surshia
91	Panicum antidotale	Poaceae	Garmano
92	Parthenium hysterophorus	Asteraceae	Congress Ghas
93	Pavonia odorata	Malvaceae	ChirikiNahl

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94	Pedalium murex	Pedaliaceae	Bada Gokharu
95	Perotis indica	Poaceae	Lonki-puncho, billiki ankh
96	Physalis minima	Solanaceae	Chirphoti
97	Plantago ovata	Plantaginaceae	Isabgol
98	Polygala erioptera	Polygalaceae	Boyasan
99	Portulaca oleracea	Portulacaceae	Luni
100	Pulicaria arabica	Asteraceae	Soneli
101	Pulicariacrispa	Asteraceae	Dholalizru, Soneli
102	Pupalialappacea	Amaranthaceae	Undiobhurat
103	Saccharum spontaneum	Poaceae	Dharbi-ghas
104	Sesamum indicum	Pedaliacae	Til
105	Sesuviumsesuvioides	Aizoaceae	Lunio
106	Sida cordata	Malvaceae	Adiobal
107	Solanum surattense	Solanaceae	Adkuntali
108	Sonchus oleraceus	Asteraceae	Aakadio
109	Sporobolus diander	Poaceae	Undar-puncho
110	Suaedafruticosa	Amaranthaceae	Lunaki
111	Tephrosia purpuria	Fabaceae	Bhakerbiyani,Bisoni, Sarpankho
112	Tragus biflorus	Poaceae	Charchara
113	Trianthemaportulacastrum	Aizoaceae	Sato, hato
114	Tribulus terrestris	Zygophyllaceae	Kanti, ChotaGokhru
115	Trichodesma amplexicaule	Boraginaceae	Sialkanto
116	Tridax procumbens	Asteraceae	Lardeolapsi
117	Trigonella foenum-graecum	Fabaceae	Methi
118	Typha angustata	Typhaceae	eroghas, Pann, Patera
119	Vallisneria spiralis	Hydrocharitaceae	Sewal
120	Verbesinaencelioides	Asteraceae	Junglisurajmukhi
121	Vernonia cinerea	Asteraceae	Sahdevi
122	Vigna trilobata	Fabaceae	Janlee moth
123	Viola cinerea	Violaceae	Khokali, Khokla
124	Withaniasomnifera	Solanaceae	Ashwagandha
125	Zygophyllum simplex	Zygophyllaceae	Lonk, Lunwo

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Fig. 1- Sewan grass (Lasiurus scindicus)