

Monsoon Herbage and Weeds: Could be an Answer to Feed Scarcity



NATIONAL INITIATIVE ON CLIMATE RESILIENT AGRICULTURE

Animal Nutrition Division

Central Sheep and Wool Research Institute, Avikanagar-304501



Monsoon herbage and weeds: Could be an answer to feed scarcity

Compared to large ruminants, cereal crop residues (e.g. straws and stovers) are generally less preferred by small ruminants. Strategies to ameliorate nutritional stress has always been aimed at meeting the belly following up with the requirement of the system. Rumen fill, thus requires availability as well as uptake of enough fibrous feeds. In this line, monsoon herbage offers a potential alternative forage source for herbivores in tropical countries especially during periods of scarcity when both quality and quantity of fodder is scarced. Further, their addition in ruminant diet can help to minimize the wide gap between availability and supply of nutrients, resulting in improved livestock productivity. These could also be used as valuable supplements, besides being added variety for increasing voluntary feed intake and may thus have considerable potential in supporting economical animal production in India and other developing countries. A list of promising grasses/plants that are abundantly grown in unutilized lands (viz. road-side, field-bonds, river or canal banks, village low and uplands etc.) with their nutrient composition are summarized in Table 1.

Table 1. Nutrient composition of different monsoon herbages

Botanical name	Common name	DM	OM	CP	EE	TCHO	NDF	ADF	Lignin	HC	C	Ash
<i>Achyranthesaspera</i>	Andhajhara	19.3	89.0	17.14	2.82	69.1	66.0	41.6	13.57	24.4	28.0	10.97
<i>Amaranthusspp</i>	Chaulai	14.7	88.3	17.61	4.87	65.9	61.5	32.9	6.19	28.6	26.7	11.67
<i>Boerhaviadiffusa</i>	Satha	25.3	84.1	13.94	3.12	67.1	73.8	45.0	14.48	28.8	30.5	15.88
<i>Commelinadiffusa</i>	Bokhna	18.5	83.3	14.45	3.49	66.3	77.4	64.7	7.33	12.7	57.4	16.72
<i>Crotalaria medicaginea</i>	Jhojhru	29.9	90.0	13.88	3.11	73.0	55.1	20.2	6.95	34.9	13.2	10.05
<i>Oxalis corniculata</i>	Khatari	17.2	86.1	16.1	2.52	67.5	58.2	28.9	8.14	29.3	20.8	13.9
<i>Indigoferacordifolia</i>	Bekaria	30.7	87.6	16.33	2.62	68.7	67.3	45.5	13.68	21.8	31.9	12.40
<i>Trianthemaportulacastrum</i>	Sabuni	13.8	78.2	20.56	3.13	54.5	43.6	30.9	6.23	12.6	24.7	21.80
<i>Tribulusterrestris</i>	Gokhru	29.4	88.5	13.89	3.53	71.1	64.9	42.6	11.72	22.4	30.8	11.52

DM Dry matter, OM Organic matter, CP Crude protein, EE Ether extract, TCHO Total carbohydrates, NDF Neutral detergent fiber, ADF Acid detergent fiber, HC Hemicellulose, C Cellulose

Achyranthesaspera L.

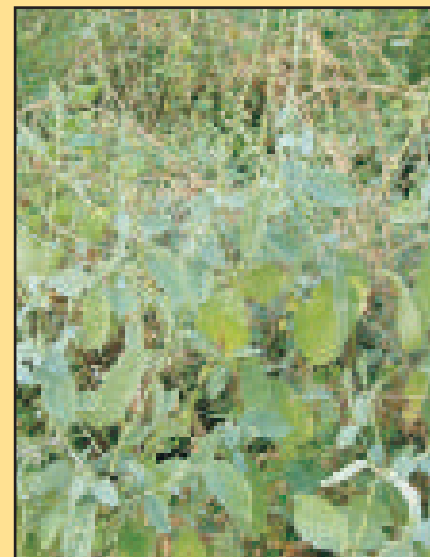
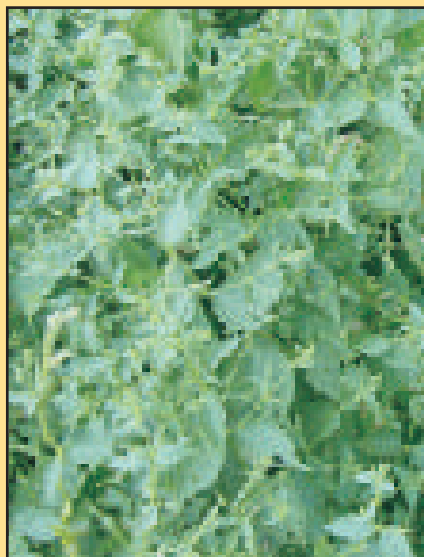
Common name: Latjeera, AndhiJhara

Family: Amaranthaceae

Flowering & Fruiting: Almost throughout the year.

Description: Erect or straggling, stiff - hairy herbs or undershurbs, 0.25 - 1.0 m; stem sulcate. Leaves petiolate, up to 8.5 x 7.0 cm, obovate – rounded or oval - obovate, cuneate, obtuse, acute or acuminate, margins entire or wavy. Spikes 20 – 40 cm long. Petals 5, subequal, ovate – lanceolate, Stamens 5; scales of pseudo – staminodes fringed. Utricle rounded at the base and truncate at the apex.

Seeds raddish - brown. Very much variable in habit, size and shape of leaves and the length of the spikes.



A. Aspera is a heat-loving perennial plant and grows in sandy soils, especially in the shade of trees and

bushes. It is a common weed in cultivated fields. But it is rich in protein (CP 16-18%) and thus can serve as a source of leaf protein concentrate. Animals used to avoid browsing these plants due to presence of spikes, but it is palatable in the juvenile stages and leaves and branches are readily browsed throughout the year.

Almost all parts of *A. aspera* are used in traditional systems of medicines to poses diuretic, hepatoprotective and emmenagogueproperties. It is used to cure several diseases, viz. malarial fever, dysentery, asthma, hypertension and diabetics. It is reported to have immunostimulatoryproperties, wound healing activity, antioxidant activity, haemolytic activity, anti-inflammatory, antibacterial activity and antifungal activity. The leaves showed the presence of phenolic compounds, oil and fats, saponins, flavonoids, alkaloids and tannins as major phytochemical groups. *A. aspera* has various medicinal usage, viz. against dysentery, cough, toothache, stomachache, piles and skin eruptions. The leaves and roots of *A. aspera* seem to be a good and safe sources of antioxidants and the phenolic compounds have potential to be used as anti-cancerous molecules.

Amaranthussps. (A. spinosus L.)

Common name: Chaulai, Kantiochandlio

Family: Amaranthaceae

Flowering & Fruiting: Almost throughout the year

Description: Erect, armed annuals, 0.5 - 0.75 m ; stem angular, Leaves long petiolate, upto 7 x 5 cm, ovate – lanceolate, ovate or oblong – elliptic, cuneate, retuse, finely mucronate or obtuse. Spines c. 1.5 cm long. Flowers in axillary or terminal, globose to cylindrical, dense spikes, green; lower flowers of the spikes entirely female, upper ones male. Bracts and bracteoles deltoid – ovate, awned by the excurrent midrib. Seeds c. 1 mm in diam., suborbicular, lenticular shining, black to brownish - black.

Amaranthus is a common weed in cultivated fields. *A. spinosus* is commonly known as spiny amaranth or Pig weed, is an annual or perennial herb and found throught India in raodsides, waste places and fields. It is self-fertile, prefere light (sandy), loamy and heavy soils. It grows just after first monsoon and fast enough to attain up to 1 m height in a month time.



It is concluded that these nonconventional leafy vegetables can be good and cheap sources of protein and minerals. Feeding experiments with sheep has revealed relatively low palatability, but once adopted to its consumption, there is considerably DM intake (>20%) from Amaranthus. It has good concentration of CP (16-20%) rich in lysine (5% of CP) and could very well replace costly protein supplements in the diet of ruminant livestock. Besides, it is a rich source of chlorophyll pigments that add to its nutritional value. Both vegetative form and its seeds are nutritious and often finds its place in human diet. There is variation in nutrient composition between wild and domestic varieties, but they have been reported to provide good amount of soluble carbohydrates and minerals (K 2.23-3.90% and Fe 0.010-0.015%). The concentration of oxalic acid could be a deterrent to its acceptability in un-adopted herbivores. It is also a rich source of vitamins (A and C).

A. spinosus leaves contain phytochemicals like fixed oils, glycosides, gum, mucilage, phenolic compounds, tannins, saponnins, flavonoids etc. which may be responsible for various pharmacological actions. The whole plant is used as laxataive. Traditionally, it has been used as diuretic, antidiabetic, antipyretic, antisnake venom, antileprotic, anti-inflammatory, immunomodulatory, antelmintic and even in skin diseases.

Indigoferacordifolia Heyne ex Roth

Common name: Bekaria,

Family: Fabaceae

Flowering & Fruiting: August - November

Description: Decumbent, obliquely erect or erect, usually much branched, white hairy herbs, Leaves subsessile, up to 2.5 x 1.5 cm, obtuse, mucronate. Flower in small, nearly sessile heads, red. Pods c. 4.5 mm long, beaked, densely appressed hairy, inner side of the pericarp with yellow spots. Seeds granular, pitted, yellow.



Indigoferacordifolia is a common weed, has rapid growth and adapts well to low fertility soil. Being sprouted soon after first monsoon, it is easy to harvest and needs inexpensive maintenance with high biomass production (up to 51 tons of DM/year/ha). In the Indian desert, a large number of weeds appear together or in succession during the rainy season when the rain-fed crops are sown. An analysis of the agro-ecosystem of the Indian arid zone revealed that not all of these weeds were deleterious to the growth of the crops. The presence of *Indigoferacordifolia*, which is a common leguminous weed growing abundantly in cultivated fields, had a beneficial effect on both the growth and yields of *Pennisetumtyphoideum* Rich. (bajra) and *Sesamumindicum* Linn. (til).

It is often referred as herbaceous legumes, which has received little attention and is rather under-utilized, but may provide better germplasm for range reseeding and pasture cultivation in semi-arid and arid regions of India. It has high CP (15-18%) and Ca contents and its palatability is good with DCP 8-10% and TDN 55-60%. Besides having good nutrient composition, *I. cordifolia* is a rich source of flavonoids with three potential sources, namely, Apigenin, Kaempferol and Quercetin. It is also reported to have good antioxidant potential prompting isolation and characterization of its chemical constituents for further research.

Tribulusterrestris L.

Common name: Gokhru

Family: Zygophyllaceae

Flowering & Fruiting: March - November

Description: Procumbent or ascending, pilose herbs. Leaves paripinnate; leaflets usually 5 - 6 pairs, up to 1.5 x 0.7 cm, ovate to elliptic – oblong. Flowers yellow. Stamens 10. Fruits 0.8 - 1.5 cm wide; mericarps 3 – 5, tuberculate on dorsal side, hairy, with two long patent and 2 short downwardly directed spines. The hirsute hairy nature helps in reducing the effect of heat stress in arid and semi-arid regions.



T. terrestris is commonly grown by the side of tanks and roads. It is a good source of CP (13-16%) and total phenolics (6-8%). It has been demonstrated that inclusion of *T. terrestris* as a protein supplement to low quality natural pasture hay diets increases dry matter intake, nitrogen balance and microbial protein yield. The vegetative powder is often used in rabbit and poultry diets as feed additives and is reported to have antimicrobial effect. Thus, it could be used as alternative to antibiotics for produce antibiotic free/organic poultry and rabbit meat for better acceptability among

consumers. It has medicinal effect against urinary calculi and is better known for its aphrodisiac properties and has been reported to provide reproductive benefits in improving semen quality of rams (spermatozoa count, time of viability and motility of sperm), and the rams exhibit good libido and active sexual behaviour.

***Boerhaviadiffusa*L.**

Common name: Satha, hogweed

Family: Nyctaginaceae

Flowering & Fruiting: Almost throughout the year.

Description: Diffuse or decumbent - ascending, glabrescent or pubescent and stalked glandular – hairy, perennial herbs. Leaves in unequal, opposite pairs. 1 - 4 x 0.8 - 3.5 cm, ovate, broadly ovate, ovate - lanceolate, ovate - oblong or suborbicular, usually cordate or rounded at the base, acute or obtuse, subentire – undulate, often white beneath. Inflorescence a panicle of subcapitate umbels. Flower pink to rose. Perianth c. 3 cm long, infundibuliform, constricted below the middle, glandular – hairy; lobes 5. Stamens 2 – 4. Anthocarp c. 4 mm long, clavate, 5-ribbed, with stalked glandular hairs throughout. It is a highly polymorphic species in respect of habit, degree of hairiness, size and shape of leaves and colour of flowers.



B. diffusa is common creeping weed in wastelands in rocky and gravelly habitats area. It is usually eaten as a vegetable (West Bengal Tribes, Assam). It has moderate levels of protein (14-16%) and grazing animals show variable preference due to its saponin and alkaloid content. The total phenolic content is high in leaves (10.44 g/kg). The proximate, vitamin and mineral compositions suggest the leaves, as cheap sources of vitamins C, B₂ and B₃, as well as other macro- and micro-nutrients, and thus can be incorporated into human and animal diet to meet their recommended daily allowances.

The plant has gained importance in the field of phytochemistry because of its various pharmacological and biological activities such as immunomodulatory effects, immunosuppressive, antimetastatic, antioxidant, antidiabetic, antiproliferative, antiestrogenic, analgesic, anti-inflammatory, antibacterial, antistress and adoptogenic activities. The content of flavonoids and vitamin C in the leaf extracts also suggests possible anti-oxidant effects of these leafy vegetables. It is an herb from Ayurveda that appears to have general anti-cancer and anti-inflammatory properties. The main active ingredients are glycoside Punarnavine and the Rotenoid class of molecules Boeravinones. It holds potent anti-oxidative effects in general, Boeravinone G being remarkably potent anti-oxidant. The flavonoid component appears to also exert direct anti-oxidative properties. The plant may have potent anti-estrogenic properties that need to be explored.

***Commelinadiffusa*L.**

Common name: Bokhna, Kena

Family: Commelinaceae

Flowering & Fruiting: Almost throughout the year.

Description: A perennial diffuse or suberect herb from a woody, knotted rhizomatous stock; roots thick. Stem annual, much branched, thickened at base and nodes, glabrous; clothed below with many, white, membranous sheaths with or without withering leaves; Leaves 5 - 11 x 1.5 - 3.8 cm, linear – lanceolate, broadest a



little above base, gradually tapering to an acute apex, slightly narrowed towards base, often somewhat longitudinally folded, glabrous or thinly sparsely hairy on upper surface, margins often straight, rarely somewhat undulate; first leaf of a branch short (2-3 x 1 cm), obtuse at apex. Sheaths 1 - 1.5 cm long, longitudinally striate, pubescent, often reddish, ciliate at margin at mouth, striate. Sheaths accompanied by 2-4 smaller leaves. Flowers borne in bifid cymes; inner by a stump/rudimentary, outer with 3-6 flowers; flowers 1-5 cm in diam, sepals 3, petals 3, violate/pale blue, clawed. Seeds black with membranous margin.

Various Commelinaceae species have been reported to have roles as ruminant feeds on smallholder farms. Its tender shoots and leaves are largely used as vegetable, by the tribals in north-eastern India. Laboratory analyses of *C. diffusa* herbage suggested a high nutritive value (CP 14-16%), but most literature reports are based on observation rather than experimentation. Inclusion in diet has been reported to improve voluntary intake, digestibility, N utilization and, possibly, production of fermentation products, suggesting that Commelina could be used as either a CP supplement or as a source of fermentable fibre which, if included in the diet, could enhance DM intake and performance of ruminants in tropical areas of the world. From a nutritional point of view, *C. diffusa* compares well with many commonly used fodder crops and could be used as protein source for ruminants on smallholder farms.

Common medicinal usage of *C. diffusa* proved useful in urinary tract infections, to remove cough with sticky phlegm and in diarrhea, hemorrhoids, enteritis, eye irritation, conjunctivitis and other eye problems like ophthalmia. The aerial parts may be useful as an alternative antimicrobial agent as natural medicine for the treatment of many infectious diseases. Phytochemical screening revealed presence of tannins, glycosides, volatile oils, flavonoids, saponins, etc.

Crotalaria medicaginea Lam.

Common name: Jhojhru

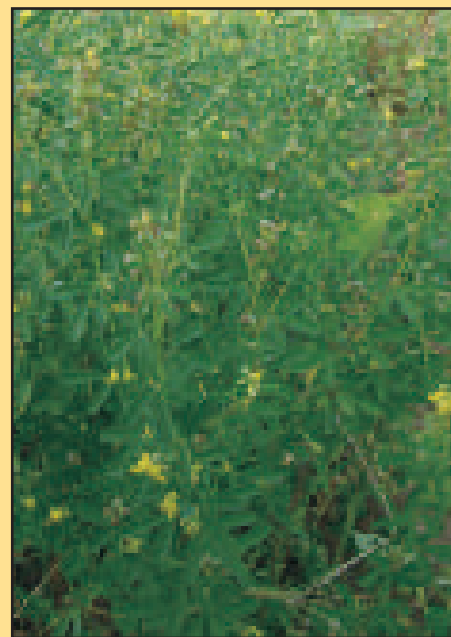
Family: Fabaceae

Flowering & Fruiting: July - December

Description: Perennial, appressed pubescent herbs, branching from a woody root stalk. Leaflets up to 3.2 x 1.0 cm, obovate or oblanceolate, rounded truncate or emarginate at the apex. Flowers in terminal or leaf-opposed racemes, yellow. Pods 4-5 mm across, obliquely subglobose, acutely beaked, pubescent, 2 seeded. Seeds suborbicular, notched at the hilum, shining.

C. medicaginea is a shrub which naturally grows on fallow land, on gravelly sandy-loam soil and has got importance in N fixation in the Indian desert. It is available in large quantity during winter just after monsoon season and is liked by ruminant livestock as well as camels. A variety of this species, var. Luxurians, common in western U.P. is considered to be a good camel fodder. The seeds may be used as cattle feed after cooking with common salt. It has moderate levels of protein (CP 13-16%) with better digestibility (75%). It has good nutritive value with >60% total digestible nutrients (TDN). The abundantly available biomass could be harvested during winter, shade dried and stored to cater the need during feed scarcity in summer. Compact and complete feed blocks can also be prepared with its incorporation by partly substituting the concentrate moiety and the levels need to be explored.

Potential phytochemicals in *C. medicaginea* have been isolated to have compounds Quercitrin, Acacetin and Isorhamnetin. The phyto-compounds have been studied to show antibacterial and antifungal activity against various gram positive and gram negative bacteria and fungi and thus the plant could serve as useful sources for new antimicrobial agents.



Trianthem portulacastrum Linn

Common name: Sabuni, Santhi, Vishakhapara

Family: *Aizoaceae*

Flowering & Fruiting: July - December

Description: Stems are prostrate or rising, somewhat succulent, up to 50 cm long or more, smooth or sparsely velvety. Leaves are flat, elliptic to obovate or spade-shaped, 1-2 cm long, 0.4-2 cm wide, margins entire, tip blunt, base rounded to wedge-shaped. Leaf stalks are 0.5-2.5 cm long, expanded into a sheath joined with opposing leaf base to form a cup. Pink flowers are borne solitary, stalkless, largely hidden in leaf axils. Petals are linear to narrowly deltate, 4-5 mm long, inner surface pink or white, sparsely velvety externally; ovary cylindrical; style about 2 mm long.



A common weed found throughout the tropical and subtropical countries especially during monsoon. It occurs in wastelands, roadsides, lawns, gardens, cultivated fields. Its infestation is very common in various agricultural and vegetable crops, such as mustard, maize, pigeon pea, mung bean, potato, onion, cotton, soybean, pearl millet, and sugarcane, especially during the rainy seasons. It is available in abundant quantity at the time of de-weeding operation. It has been observed that cattle prefers this weed in preference to other weeds and herbage. *T. portulacastrum* appears to be a viable unconventional fodder due to its richness in protein (CP 21.56%) and preference by livestock. Different parts of this plant are used in Ayurvedic medicine. Photochemical screening has revealed the presence of steroids, flavonoid, fats, terpenes, carbohydrates, tannins, and alkaloids. Laboratory investigations on extracts of the plant have demonstrated significant pharmacological activities, such as antioxidant, diuretic, analgesic, hepatoprotective, and anticarcinogenic. The plant has been used in the indigenous system of medicine for the obstruction of the liver asthma, amenorrhea, dropsy, edema, ascites, and beri-beri.

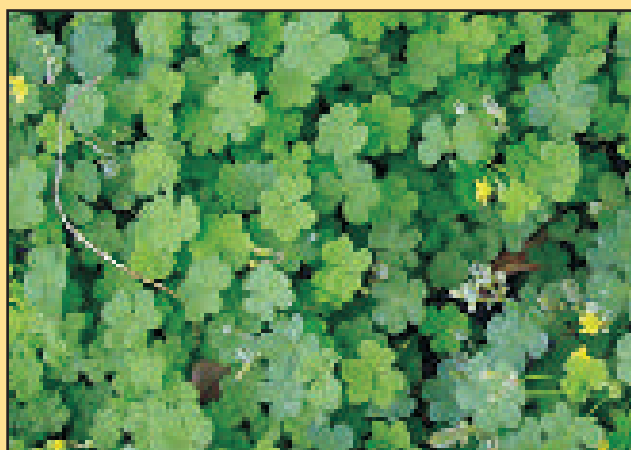
Oxalis corniculata L.

Common name: Khatari, Amrul

Family: *Oxalidaceae*

Flowering & Fruiting: Almost throughout the year.

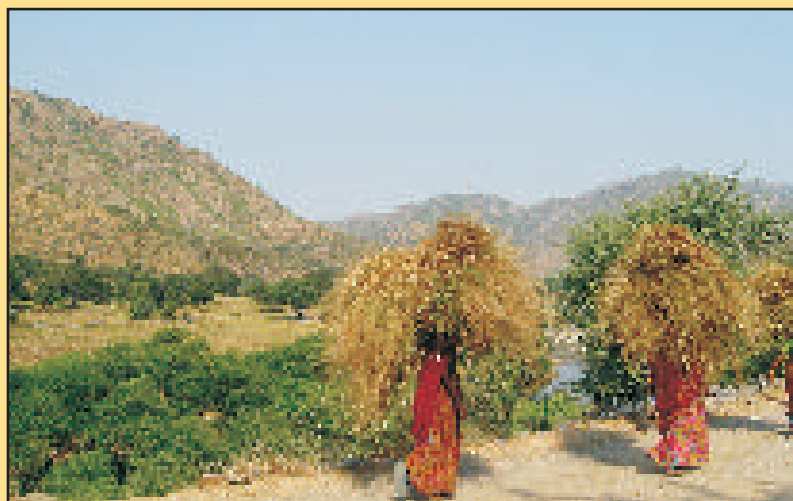
Description: It is commonly known as 'Creeping wood sorrel' and is a world-wide weed which is almost impossible to get rid of. Branching from the base and often rooted at the nodes, the upper portion is ascending or weakly erect, smooth or hairy. The leaves are arranged alternately along the stems, trifoliate with three small heart-shaped leaflets, petiole-green, thin, about 3-9 cm long, cylindrical, pubescent; leaflet-green, 1-2 cm long, obcordate, glabrous, sessile or sub sessile; taste, somewhat sour. A single long stalk arises from the axils of the leaf, from which extend three flower stalks, each with a single flower. The flowers are 7-11 mm wide and have 5 yellow petals. The fruit is a capsule, 1-1.5 cm long, cylindrical, pointed apically, and 5-ridged in cross section.



It is a somewhat delicate-appearing, low-growing, herbaceous plant abundantly distributed in damp shady places, roadsides, plantations, lawns, nearly all regions throughout the warmer parts of India, even in the Himalayas up to 8,000 ft. It is a common garden weed infesting lawns, flower-pots etc. But, nutritionally the leaves are rich in CP (12-16%)

and minerals (1.5% Ca, 0.78% P, 0.08 mg Fe) and vitamins (niacin, vitamin C, β -carotene). This herb is well known to have an acid taste due to the high content of oxalate (7-12%) in its leaves and stems, and thus should not be consumed in large amounts since oxalic acid can bind up the body's supply of Ca leading to nutritional deficiency.

Phytochemical investigations of *O. corniculata* have revealed the presence of tannins, palmitic acid, a mixture of oleic, linoleic, linolenic and stearic acids. There is presence of glycosides, phytosterols, phenolic compounds, flavanoids and volatile oils that provides medicinal properties. Traditional uses of this plant were enlisted as an antiscorbutic in the treatment of scurvy, in stomach trouble, in case of scorpion sting, to stop bleeding from wounds, to get relief from aphthae, to treat giddiness, diarrhoea and dysentery.



Save for
tomorrow



Compiled by: **A. Sahoo, O.H. Chaturvedi, R.B. Sharma, M.C. Meena and S.M.K. Naqvi**

For further information

Dr A. Sahoo, PI, NICRA, CSWRI, Avikanagar; Tel. 1437-220143; Email: sahoorta1@gmail.com

Publisher:

Central Sheep and Wool Research Institute, Avikanagar, Rajasthan-304501
(Indian Council of Agricultural Research)

Tel. 91-1437-220162; Fax: 91-1437-220163

Email: cswriavikanagar@yahoo.com; Website: <http://www.cswri.res.in>