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JAII- (AVENA SATIVA LINN.)- A PROMISING CEREAL

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Abstract- Ayurveda emphasizes on preventive aspects rather than curative. Ayurveda has got three fold management of all diseases viz., Ahara (diet), Vihara (exercise) and Aushada (drug). A properly selected diet and diet plan plays a critical importance in the management of any disease. There is a surge of oat cereal in market. Oat is a yavak, which is decribed under kudhanya varga in samhitas and nighantus. This papers reviews the botanical description of Jaii, its uses, action, pharmacological activities along with whole cultivation practices..

INTRODUCTION-

Jaii is commonly known as Oat. Oat (*Avena sativa Linn*.) rank sixth in the world cereal production following wheat, maize, rice, barley and sorghum. World production of oat, however, has been showing a declining trend partly due to increased mechanization, greater emphasis placed on competitive crops yielding higher amounts of proteins or energy per hectare, or increased specialization in production technology requiring more chemical usage and less crop rotation.

Oat is a cereal once important as human food in parts of northern Europe but now used mainly as animal feed, especially favoured for horses. There is currently a resurgence of interest in the crop owing to considerable scientific evidence to support its use as food, feed and fodder[1].

We get a specific term Jaii in Bhavaprakasha Nighanṭu. Atiyava and tokya is mentioned along with yava (barley) in dhanya varga with specific morphological characters. Atiyava is without shuka (bristle) and black-aruna (red) colour. Tokya is also without shuka (bristle) but smaller variety of yava (barley) and it is known as 'Jaii'. Many vaidya consider yavaka mentioned in samhita is Jaii[2].

The separate division of Kudhanya varga was first mentioned by Acharya Susurta[3]. Dravyas of Kudhanya varga occupy relatively lower position among food grains. Kudhanya is not widely used as food regime but various references are found in ayurvedic text that by using these cereals as a pathya can help in improving life style disorders like Medoroga, Diabetes and skin disorders etc.

Botanical Description-

Habitat - The distribution of different wild and weedy species is confined mainly to the temperate northern hemisphere. The countries bordering the Mediterranean Sea, Turkey, Iran, Iraq, and parts of the former USSR, are rich in diversity of species. It is grown in Uttar Pradesh, Madhya Pradesh, Haryana, Punjab, Himachal Pradesh, Rajasthan, Bihar, Gujrat, Andra Pradesh and Tamil Nadu. In southern part of the country, it is cultivated in the hilly regions[1].

Habit- An annual, erect and tufted grass.

Height- 50 to 100 cm (0.5 to 1m)

Root- Fibrous, 0.5 cm thick, glabrous and grayish brown in colour.

Stem- Hollow, jointed stems (clums) bear terminal, panicle like flowerheads.

Leaves- The leaves are long and narrow with a sheath clasping the stem and a large ligule (a strap of tissue at the base of the leaf).

Inflorescence and spikelet- Each part (spikelet) of the drooping flowerhead contains two or three florets enclosed by two chaff like bracts (glumes).The lower bract (lemma) usually does not have an awn- a bristle like projection.

Fruit Caryopsis with pointed ends;1 cm long and 0.1 to0.2 cm wide.

Grains / Seeds: The grains are tightly enclosed and adhering the lemma and palea.

Flowering and Fruiting: During February-April.

Part used: Grains

Chemical composition

Seeds- Seed contains a principle called "avenin" the nitrogenous principal of Avena sativa and somewhat resembles legumin, soluble polysaccharide, proteic substances,peptides,sterol saponins,sterol,fatty oil,vitamins of B-group and amines. 1,3,4 – pentanetricarboxylic acid trimethyl ester (seed husk);

Leaves- Avenalumin I

Whole Plant- Fat, Sugar, Starch, albumin soluble and insoluble, cellulose, mineral matter and moisture,soluble oligo and polysaccharides , silicic acid, steroid saponins, aminoacids (Avenic acid A&B) and flavonoids; Graminne, a vasorelaxing alkaloid acting on 5-HT2A receptors, 2 β – D- glucopyranosyloxy – 2 – methylpropionitrile (linamarin) and Nicotianamide along with avenic acid A and its derivatives isolated from seedlings[4].

Ayurvedic pharmacodynamics

Rasa -Madhura - Kashaya

Guṇa – Guru, ruksha, pichhala and sara

Virya - Shita

Vipaka- Katu

Effect on dosha- Kapha-pittahara and Vata vardhaka action

Organoleptic Character-

Sparsh (Touch)- *Snigdha (smooth), Khara(rough);* Husk is *Alpa-Kaṭhina (quite hard)* –

Rupa (Apperance) – *Kinchit pitabha –shweta varna* (yellow- whitish, brownish)

Rasa (Taste)- *Madhur Kashaya* (Sweet- astringent)

Gandha (Smell)- No particular smell.

HISTORY

Although the many uses of *Avena sativa L.* are obvious, its origins are obscure. Oats are claimed by the Mediterranean, Near-East, and China-Japan centers of diversity, but the specific source of cultivated oats remains unknown. It is speculated that the intentional cultivation of oats occurred in the Caspian and Caucasian plains or in the bordering plains of Turkmenistan. As far as early history, oats were unpopular with the Romans, who labeled them the "barbaric bread grain of the Germans." Even the famous Roman historian Pliny believed oats were "a weed among cereals that could only lead to the degeneration of barley." Despite negative beginnings, the nutritious value of oats was recognized in the Middle Ages, with a 1737 publication by Lonicerus, who canonized the utility of oats as a food crop[5].

In book, *Food Plants of the World*, it is described as Oats are originated as a weed of other grains(mainly barley and wheat) and represents a hybrid between several wild species, including the European A.*byzantina* and the Ethiopian A.*abyssinica*. Oats appears relatively late in the archaeological record (1000 BC) in central Europe. It has long been used as a staple food for humans (in the gruels of the Gauls, Romans and Teutons) and later also Scandinavia and Scottland. The straw is an important source of roughage for farm animals[6].

In India - Oat is an introduced crop in India. The exact time and place of its introduction cannot be ascertained with certainty. However, there are references to Oat cultivation in Ain –I-Akbari written by Abul Fazal, the court historian of Mughal king Akbar, in 1590. It is generally believed that large scale Oat cultivation started in India during the beginning of 19th century when the British established remount depots for the Indian Army. As far as extension of its cultivation in the Himalaya is concerned, it is comparatively recent. It was first introduced in the Jammu and Kashmir State by the then King, Maharaja Hari Singh (1925-1947) in his stud farms. The seeds were imported from Europe. During this period, cultivation of Oats remained confined to the King's farms only and local farmers were not using Oats. Its introduction in the Himalayan region started earnestly in late seventies, after the establishment of an Agrostology wing of J&K Department of Agriculture in Jammu and Kashmir, Himachal Pradesh Agricultural University at Palampur and G.B. Pant Agricultural University at Pantnagar[7].

Action [8-] It is considered as a most nutritious cereal containing a fair proportion of all the food elements. But it should not be used as the sole article of diet for a long time even with the addition of milk, on account of its tendency to produce skin eruptions due to the irritating qualities of "avenin" one of its ingredients. It is a nerve stimulant as a tincture.

Uses [1 4 6 8] -This is an unrivalled fodder crop for horses in India.Food consumption of oat in most countries tends to be low but has begun to grow in form of oat meal, oat granola, baby food and bran. When body is ill- nourished and bodily vigour is low,creamed oatmeal,or oatmeal Blanc-mange is very valible.In the form of tincture (of green Oats) it is recommended for all liable to much nervous strain.The dose is from 10 to 20 drops in alittle hot water taken twice a day;in a dose of 4° drops as a soporific, as an antidote in morphinism,alcoholism,dyphtheric paralysis (in rather smaller dosage),also in dysentery (for nocturnal restlessness). Oatmeal may be advantageously used in lieu of soap by dry skinned people. Oatmeal can be baked into cake or biscuit ,but owing to the difficulty of rupturing the starch grains; contained in it, except at very high temperatures, the meal does not lend itself to bread making. Processed oat flour also provides a base for some cosmetic products and is used as an antioxidant in food products. Oat hulls, a food processing by product, may be used as an animal feed, fuel for power plants or in manufacturing chemicals. Oat hulls are a basic raw material in the production of furfural, a chemical intermediate in the production of a number of important industrial products such as nylon, lubrication oils, butadiene, phenolic resin glues and rubber tread materials.

Review of some important Pharmacological and Clinical Activities:

Antihypercholesterolemic activity: A dosage of 6 grams concentrated β-glucan per day for six weeks produced significant reduction from baseline in total and LDL cholesterol. The reduction in LDL cholesterol was significantly greater than in the control group. These results indicate that concentrated β-glucan may be beneficial to high cardiovascular disease risk populations[9].

Antioxidant activity: Oat (Avena sativa L.) and amaranth (Amaranthus hypochondriacus) meals positively affect plasma lipid profile in rats fed cholesterol-containing diets The purpose of the current study was to compare oatmeal was compared with amaranth meals to determine whether this pseudocereal can be substitute for allergic to cereals individuals . Oats have shown more antioxidant activity than Amaranthus[10].

Reduction the craying for cigarettes: The pharmacology of Avena sativa has been investigated in laboratory animals following a report that tincture of Avena sativa reduced the craying for cigarettes in man. However, the aqueous extract prepared from the tincture did not affect the seizure threshold to bemegride or nicotine or the sleeping time induced by barbitone sodium[11].

Hypocholesterolemic activity: The physiological effects are probably related to the gel forming properties of *β*-glucan, which increase viscosity of intestinal chyme. And increased viscosity disturbs micelle formation, which may inhibit cholesterol absorption, slow cholesterol transfer across the unstirred layer, and increase bile acid excretion by inhibiting bile acid reabsorption[12].

Cardiovascular Diseases: In oat, the mixed-linked (1-3, 1-4)-*β*-D-glucan, referred to as *β*-glucan, is a major component of the endosperm cell walls (Burke et al., 1974). As a high-molecular weight water-soluble fibre, *β*-glucan contributes to the main health benefits of oat for that it lowers the serum cholesterol levels of blood and balances the glucose and insulin contents of serum after meals, reducing the risks of cardiovascular diseases[13].

AGRONOMY-

Climate and Soil: Climatic factors are very important in determining the location for growing Oat. Cool moist climate is considered the best for oat, because of its higher water requirement to produce a given unit of dry matter compared with any other cereal crop except rice. Therefore, Oat crop is more likely to be injured by hot, dry weather, especially from heading through the grain filling period. Its cultivation is generally more successful in areas where the 21°C- 24 °C temperature prevails. At low temperature, its germination is delayed. The range of temperature for oat cultivation varies from 5°C to 30°C, whereas optimum temperature required is 25°C.

Crop rotation: Oat is cultivated in combination with mustard and berseem. Seed of berseem and oat in 1:1 ratio makes a very good combination. Pea *(Pisum sativum),* Lathyrus and Senji *(Melilotus indica)* also make good combination with oat.

Cultivation:

Land preparation: The land should be ploughed well or worked with a blade harrow 3 or 4 times. There should be a gap of about a month between the harvesting of the previous crop and the sowing of oat to allow the stubble to decay well.

Sowing time: The sowing season lasts from October to early January. Under Indian conditions, October (first week) to December (second week) is considered the best sowing period. For forage (multi cut) the crop should be sown in October.

Method of sowing: Usually, the seed is sown broadcast for fodder crop, and in rows 25-30 cm apart, if the crop is meant for grain. Although Oat is typically sown at a soil depth of 2.0-4.0 cm, they are less sensitive to deep planting than wheat, barley or rye. Thus, oat is often sown with less tillage than other crops, because the seedlings emerge well irrespective of the depth of seed placement.

Seed rate: The seed rate varies from 70-80 kg (seed crop) to 90-100 kg (fodder crop) per hectare.

Irrigation: Water requirement depends on soil type and climate. In general, the oat crop requires 3 to 4 irrigations. For maximization of yield, the crop should be irrigated at 60 mm cumulative evaporation, as measured with open pan evaporimeter. The tillering and heading (before and after) stages are critical for irrigation.

Fertilizer application: To obtain the maximum yields, adequate nutrients must be present throughout the growing season. Oat plants will be less vigorous with smaller leaves and panicles, and less developed root system, if the nutrients are scarce in the first half of the growing season. The nutrients deficiencies in the later growth stages adversely affect seed set and grain filling. Proper nutrient management is influenced by the previous crop, soil moisture and rainfall pattern, capability of soil to supply essential nutrients, cultivar used, time of fertilizer application, likelihood of lodging and the nutrients source. When grown as a grain crop, manure is generally applied to the previous crop in the rotation to prevent lodging. For the fodder crop, a fairly heavy basal application of organic manure supplemented with top dressing of nitrogenous fertilizers is practiced to enhance early growth of the plants. The application of 40-100 kg N/ha and 20-30 kg P_2O_5 /ha has been beneficial, depending on the factors as mentioned. For multicut forage crop, nitrogen is applied in split doses after each cutting.

Diseases and Pests: Oat, like all other major crop plants, suffers from wide range of diseases and pests. All the stages of plant growth and development can be affected. The economic success of the oat production is ultimately tied with the availability of resistant varieties. Information on some of the diseases and pest is summarized here:

1. **Crown rust (*Puccinia coronate avenae*)** : It is the most important disease of oat with worldwide distribution and is important in temperate climatic regions of India. The characteristic symptom is the presence of small orange lesions on the surface arranged in lines covering the entire leaf.
2. **Stem rust (*Puccinia graminis avenae*):** It is an important disease of cereals and grasses throughout the world. The uredial and telial pustules appear on stem and leaves, and adversely affect the plant growth. This disease reduces the forage yield and quality as well as grain yield.

3. **Leaf blotch *(Helminthosporium avenae)*:** The symptoms of the disease appear in the form of small brown, necrotic spots which coalesce and form larger spots of irregular shape and size. Heavy infection results in leaf damage and reduced seed yield. This disease is particularly severe in northern region of the country.
4. **Sclerotial wilt *(Sclerotium rolfsii*):** Though this disease is of minor importance in all the oat growing areas of the country, it has recently become an important seedling disease causing considerable damage to the crop at a few specific locations in northern and eastern pats. It causes wilting of the seedlings.
5. **Stem bore (*Sesamia inferens*) :** Insect pests do not cause much damage to oat India. Borers are sporadic but mild in their attack in north India. The caterpillar bores the plant and makes dead hearts in the young stage.
6. **Cyst nematods (*Heterodera avenae*) :** This is the first cyst forming nematode reported from India in 1958 from Rajasthan, causing considerable damage. Root knot nematode (*Pratylenchus spp*) is other important species found to damage this crop.

Harvesting, threshing and yield: The crop matures in 30-150 days. For fodder production, 2 to 4 cuts are taken from December to April and the crop is allowed to set seed in some cases. When the crop is grown for fodder, one, two or more cuts can be taken. For single cut, plants are harvested once at 58% flowering stage. For 2 cuts, the first is taken at 65-70 days after sowing and the second at flowering. For more than 2 cuts, the first cut is taken at 50days after sowing and the subsequent cuts at 30 days interval. For dual purpose oat, the plants may be allowed to produce grains after the first cut as forage.

For grain, usually the crop is harvested at grain maturity. However, highly fertile soils, 1 cut as forage at 50 days after sowing may be taken to avoid lodging of plants. Harvesting should be done when the grains are mature, but the straw is still somewhat green, otherwise there is likelihood of loss of grain due to shedding. Threshing should be done in the same manner as for wheat and barley. With normal cultivation practices, the crop produces 50-60 tonnes/ha green fodder and 2-3 tonnes /ha grain.

Varieties: The earlier varieties, viz. Algerian, Brunker 10, NP 101, FOS 1/29, Haryana Javi 114, Western 11 and Kent, recommended before 1980 for cultivation, are being replaced by the recent releases. However, the variety Kent appears to be an exception. This variety still holds good for its utility both as fodder and grain variety adapted to the entire oat growing areas of India. Most of the varieties released are predominantly fodder types. But, some of them possessing bold grains may be used as grain crop.

Among the recently recommended varieties, OS 6,OS 96 ,OS 108 , UPO 94 ,UPO 212 and OL 125 are adapted to the entire oat growing areas of the country. The OS 6, OS 108 and OL 125 are single cut types, whereas OS 96 , UPO 94 and UPO 212 are suitable for multicut. Varieties recommended for specific areas or zones include OS 7 (Haryana) ,Palampur 1 (Himachal Pradesh),OL 9 (North and North- West Zones), Bundel Jai JHO 822(Central Zone),JHO 810 (Jammu & Kashmir),JHO 829 (Hill Zone) and OL 88 (North –West Zone). Bundel Jai JHO 822 possessing bold grains ia a dual purpose variety, suitable for both forage (multi- cut) as well as grain production.

Recently, a new variety Bundel Jai 851 (JHO 851) has been recommended for cultivation for the entire country. This is a long duration multi-cut variety with excellent regeneration ability (4 cuts), high tillering potential and better forage quality. This is resistant to crown rust and other leaf diseases. It is grassy type leafy variety with soft touch. It yields 50-55 tonnes/ha green forage under good fertility and irrigated conditions. It is highly suitable for areas with intensive and high production potential.

Recently identified varieties JHO 99-2 and JHO 2000-4 are suitable for cultivation under single – cut situation[1].

Conclusion: It is a time to reintroduce the Jaii again in main diet due to its high nutritional value. It can be good substitute of protein, fibres and minerals in diet. If we use Jaii with water the ruksha property is dominating. It should be advisable to use oat with milk and ghee to subside this property. It is also advised oat should not to be used as the sole article of diet for a long time even with the addition of milk, on account of its tendency to produce skin eruptions due to the irritating qualities of "avenin" one of its ingredients. But

recent nutraceutical market is trying to globalised oat as a dietary supplement and our country is also trying to follow this trend. This can be proving a good cereal in diet with little precaution.

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