

Agronomy – Rabi Crops

Niger

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NIGER

Botanical name: *Guizotia abyssinica* (L.f.) Cass

Family: Asteraceae (compositae)

Chromosome Number: 2n=30

Niger, a minor oilseed crop i.e. important under rainfed conditions, coarse textured, poor soils especially on hill slopes. Niger seed is used as a human food. The seed contains 37-47% oil, which is pale yellow with nutty taste and a pleasant odour. The oil and seeds are free from any toxin and oil taste is similar to *desi* ghee. The oil is readily subject to oxidative rancidation rendering its keeping quality poor due to high content of unsaturated fatty acid (oleic acid 38% and linoleic acid 51.6%). The oil is used for culinary purposes, anointing the body, manufacturing paints and soft soaps and for lighting and lubrication

The niger oil is good absorbent of fragrance of flowers due to which it is used as a base oil by perfume industry.

Niger oil can be used for birth control and treatment of syphilis. Niger sprouts mixed with garlic and 'tej' are used to treat coughs.

Niger seed cake is a valuable cattle feed particularly for milch cattle. Niger meal with 30% protein and 17% crude fibre in India could replace linseed cake in calf ration. It can also be used as a manure. Niger is also used as a green manure for increasing soil organic carbon.

Geographic Distribution

India is the most important country accounting for more than 50% of world niger area and production. Niger constitutes about 50-60% of Ethiopian oilseed production, with an area of nearly 2 lakh ha and production of about one lakh tonnes with a productivity level of 500 kg/ha. In Ethiopia, it is cultivated on water logged soils where most crops and all other oilseeds fail to grow and contributes a great deal to soil conservation and land rehabilitation.

In India, niger is grown on an area of 0.52 million ha mainly during *kharif*. However, in Orissa it is a *rabi* crop. Madhya Pradesh, Maharashtra and Orissa contribute more than 80% of area and production. Other states where niger is grown are Andhra Pradesh, Bihar, Karnataka and West Bengal (Table 1).

Table 1. Area, production and Productivity of Niger in different states of India (2003-04)

State	Area (000, ha)	Production (000 t)	Productivity (kg/ha)
Andhra Pradesh	17.0	7.0	412
Assam	9.7	5.0	515
Chattisgarh	70.8	12.5	177
Jharkhand	27.5	5.3	193
Karnataka	7.0	1.0	143
Madhya Pradesh	112.2	25.8	230
Maharashtra	54.0	17.0	315
Orissa	130.2	31.9	245
West Bengal	8.0	5.0	625
India	437.0	111.0	253

Origin and History

The evidences suggest that niger originated in the highlands of Ethiopia, north of 10°N latitude. Cultivated niger might have originated from the wild species *Guizotia scabra* subsp. *schimperi* due to selection by Ethiopian farmers thousands of years ago. The genus *Guizotia* has 6 species. All species except *G. abyssinica* are wild and are endemic to East Africa especially Ethiopia (Table 2). From Ethiopia, the cultivated niger is believed to have spread to India during third millennium BC along with other crops, such as finger millet. Niger's wide dispersal in India is indicated by the great variety of local names for the plant and seed.



The Plant

Niger is an annual dicotyledonous herb. with epigeal germination. The root system is well developed, with a central tap-root and its lateral branching.

The stem of niger is usually round, smooth to slightly rough, hollow and moderately branched.

The fruit is an achene, small, 3-5 mm in length and 1.5mm in width, almost lanceolate in shape, without pappus. There are usually between 15 and 30 mature seeds/head; occasionally more, and a varying number of immature seeds or pops at the centre.



Crop Adaptation

Niger is a crop of the cooler parts of the tropics. It grows well in mid altitude and highland areas (1600-2000 m), 500 and 2290 m above mean sea level in Ethiopia but can be found at lower (500-1600 m) and higher (2500-2980 m) altitude with adequate rainfall. Ethiopian niger types are short day and the Indian types are quantitatively short day in photoperiodic response. Ethiopian types flower best at 18°C day and 13°C night temperatures and 12 hours day length. Day length > 12 hours and temperatures of 23°C and above delay flowering. No such effect of temperature on Indian types was observed on flowering.

A rainfall of 1000 - 1300 mm is considered as the optimum. Growth is adversely affected in areas receiving rainfall above 2000 mm, but the plants can withstand high rainfall during vegetative phase. Hence it is most suitable crop for hilly regions of high rainfall and humidity. The peak flowering period of the crop should not coincide with the rainy period as this would affect pollination by honey bees, resulting in poor seed setting. High wind or hail, when the seed is mature, it will cause severe shattering. The crop can also withstand drought.

Soils

Niger can grow on a wide range of soil types, but thrives best on clayey loams or sandy clays. The crop prefers well drained soils in the pH range of 5.2 to 7.3. Niger tolerates waterlogged soils, since it grows equally well on both drained soils or waterlogged clays. Niger is a salt tolerant but its flowering is delayed with increasing salinity.

Varieties

The breeding work carried out at different locations under All India Coordinated Research Project on Oilseeds - Sesame and Niger (JNKVV, Jabalpur) since 1967, has resulted in the release of several varieties suited to different agroecological conditions (Table 3).

Table 3. Niger varieties recommended for different states

State	Variety
<i>Madhya Pradesh</i>	Birsa Niger-1, N-5, Ootacamund, Jawahar Niger Composite-1
<i>Andhra Pradesh</i>	KRN-1 (No. 71)
<i>Bihar</i>	Birsa Niger 1, N-5, Ootacamund
<i>West Bengal</i>	KRN-1, Sahyadri
<i>Orissas</i>	GA-10 (Shiva) (Deomali), Bhavani (GA-5), Sahyadri, KRN-1
<i>Rajasthan/Maharashtra/NEH/Uttar Pradesh</i>	Sahayadri (IGP-76)
Karnataka	Shrilekha
Gujarat	RCR-317
Tamil Nadu	Paiyur-1, KRN-1

Land Preparation

Niger being a small seeded crop require friable and levelled seed-bed to ensure uniform depth of planting and subsequent emergence. Good tilth for sowing is obtained by one or two ploughings followed by two harrowings wherever feasible. It is essential that the furrows run across slope to avoid soil erosion in the hill tops and slopy areas.

Seeding

Time of sowing

Optimum sowing time for *kharif* crop is from mid of June to early August whereas *rabi* crop can be sown from September (semi *rabi*) to December (*rabi*). Appropriate sowing period for niger in different states in India is given in Table 3.

Table 4. Sowing time for niger in different states

State	Optimum time of sowing
Andhra Pradesh	Second week of August
Bihar	Second fortnight of August-September (After <i>kharif</i> crop)
Karnataka	June-August
Madhya Pradesh	Second-third week of July
Maharashtra	July to early September (after <i>kharif</i> crop)
Orissa	Third week of July – first week of August Second fortnight of August-September (after <i>kharif</i> crop)

Seed rate and spacing

Niger is a small seeded crop and seed rate varies from 5-8 kg/ha for sole cropping. Row widths varies from 20 to 30 cm and intra-row spacing from 10-20 cm. In Andhra Pradesh, Karnataka and Madhya Pradesh, a spacing of 30 x 10 cm is adopted. However, in Bihar and Maharashtra, wider intra row spacing (15 cm) is adopted keeping a row spacing of 30 cm. In Orissa, 20 x 20 cm spacing is recommended.

Method of sowing

The most usual method of sowing is broadcast. However, line sowing using seed drills is recommended. When mechanical planters or drills are used, the seed should be sown 1-3cm deep, depending on soil type and the amount of soil moisture. Seed could be placed in soil up to 10 cm depth in loose soils provided the drill furrow should not be completely filled. The seed should not be mixed with fertilizer, nor placed in contact with it in the seed-bed. Seed must be sown into moist soil.

Seed treatment

Seed treatment is recommended to protect the crop from seed borne or to some extent soil borne diseases. The seed should be treated with thiram, captan or any other mercurial fungicide at the rate of 3g/kg of seed prior to sowing.

Nutrient management

It is generally grown on residual fertility in *rabi* or on fertilizers applied to associated crops. Nitrogen application seldom exceeds 50 kg/ha. At higher N application rates, seed oil content decreases.

Since niger is usually grown on the same land for many years either in pure stands or intercropped, 40 kg P₂O₅/ha is recommended. However. Lower level of 10 kg P₂O₅/ha would be sufficient, when niger follows well fertilized crops in a rotation.

Generally, entire quantity of P and half of N is applied at the time of sowing and the remaining half of N is topdressed 30-35 days later plants are about 30 cm in height or when the first bud is noticed.

Cropping Systems

Niger is sown as a sole or mixed crop with finger millet, castor, groundnut, soybean, sorghum, mungbean, chickpea, sunflower etc. Niger is generally grown as the only crop in a year. In certain situations, this crop is rotated with little millet (*Panicum miliare*), early finger millet, common millet (*Panicum miliaceum*) etc. as given below:

State	Sequential cropping	Intercropping
Bihar	Little millet – Niger; Early fingermillet – Niger	Niger + fingermillet (2:2); niger + pigeonpea (3:2); niger + soybean (2:1); niger + urdbean (2:2); niger + groundnut (2:2)
Maharashtra	Fingermillet-niger horsegram-niger	Niger + urdbean (3:3); niger + mungbean (2:2); niger + fingermillet (2:2); niger + groundnut (6:3); niger + pearl millet (3:3)
Orissa	Little millet – Niger;	Niger + soybean (1:1, 2:2); niger +

State	Sequential cropping	Intercropping
	Common millet - Niger Finger millet – Niger	pigeonpea (2:2); niger + finger millet (6:3); niger + groundnut; niger + castor
Karnataka		Niger + sunflower (4:2); niger + groundnut (6:3); niger + finger millet (1:1)
Madhya Pradesh		Niger + soybean (1:1, 2:2); niger + mungbean (1:1); niger + groundnut (4:2, 6:3); niger + sorghum

Weed management

Niger grows rapidly once the seedlings are established, and its vigorous growth allows it to compete with annual weeds, provided majority of weeds are removed in pre-planting operations. Two weedings are generally adequate. The first weeding should be done at the time of thinning (15 days after sowing), and if required, second weeding is done before top dressing of N or just before appearance of first bud.

In Orissa, dodder (*Cuscuta chinensis* L.) has become a problematic parasitic weed bringing down the seed yield by 60-65%. As a precautionary measure, seeds should be obtained from *cuscuta* free areas. A 90% control of dodder has been achieved using propyzamide @ 1.5-2.0 kg/ha as post-emergence (20-25 days after sowing). The *cuscuta* can also be controlled by pronamide @ 2 kg/ha as pre-emergence soil treatment on the next day of sowing and as post-emergence foliage treatment at 20 days after sowing.

Water Management

Niger, a *kharif* crop, is seldom irrigated. Seedling stage is most critical for irrigation. However, established niger plants can withstand high soil moisture levels and recover to produce a good seed yield. Irrigation must be given at the seedling stage for proper growth of the crop. Check basin or border strip system of irrigation is ideal for niger.

Harvesting and Threshing

Niger normally matures in about 80-145 days after emergence. Correct time of harvesting of niger is important to avoid shattering.

In India, the crop is harvested when the leaves dry up and the head turns blackish. After drying in the sun for about a week by stacking on the threshing floor, the crop is manually threshed or threshed by bullocks.

Yield

As a pure crop, a seed yield of 0.4-0.5 tonnes/ha while as an intercrop 0.15-0.30 tonnes/ha can be obtained depending on the crop and the row ratio.

The oil to seeds crushed is 28% and cakes to seeds crushed are 72%. The main yield attributes of niger are given below.

Attribute	Value
Seeds/head	15-30
1,000 seed weight (g)	3-5

Table 2. Distribution and Characteristics of niger species

Species	Distribution	Characteristics
Annual <i>Guizotia abyssinica</i> (L.F.) Cass	Cultivated in East African & Indian sub-continent	-
<i>G. scabra</i> (Vius.) Chiov. Ssp. <i>Schrni peri</i> (Sch. Bip. In Walp.) Bogg	Native to Ethiopian highlands	Moderately branched weed especially in niger cultivation, with outer involucre leaves ovate, shorter than disc center
<i>G. villosa</i> Sch. Bip.	Distributed in Northern and South-western Ethiopian highlands	Highly branched, weed of open places
Perennials <i>G. scabra</i> (Vis.) Chiov. Ssp. <i>Scabra</i>	Distributed widely from Ethiopia to Zimbabwe in the south to the Nigerian highlands in the west	Moderately branched, scabrous, suffrutescent herb and differentiated from annual ssp. <i>Schimperi</i> in having outer involucre leaves lanceolate
<i>G. reptans</i> Hutch	A rare species with distribution restricted in Mount Kenya, the Aberdares and Mount Elgon region in East Africa. It is only sp. not reported in Ethiopia	Sparsely branched, a creeping, much-flooding herb
<i>G. zavattarii</i> – Lanza	Endemic in distribution around Mount Mega in Southern Ethiopia and Hari Hills of Northern Kenya	An erect, glandulous predominantly shrub habit
<i>G. arborescens</i> L. Frcis.	Endemic to South West of Ethiopia and Imontong mountain on the border between Sudan and Uganda	A rare arboreal species

Additional Resources

<http://www.biodiversityinternational.org/publications/pdf/136.pdf>