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Truthful label seed production techniques of Kodo millets under seed hub on millets in Bundelkhand regions

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Abstract

JK-137 & TNAU-86 varieties of Kodo millet were used for foundation & Truthful label seed production. All good recommended agronomy practices were following for seed production programme. All genetic principles such as isolation distance, roughing were followed during seed production programme. A good crop strength was found with good seed setting, etc. and good population of seed crop. After seed production, the seeds were processed (cleaning, grading, treating, storage, packaging, etc.) for distribution to the farmers.

Keywords: Truthful, label, techniques, Kodo, Bundelkhand

Introduction

Kodo millet (Vargua) *Paspalum scrobiculatum*, commonly called Kodo millet or Koda millet, is an annual grass that is grown primarily in Nepal (not to confuse with Kodo (Finger millet, *Eleusine coracana*) and also in the India, Philippines, Indonesia, Vietnam, Thailand, and in West Africa from where it originated. It is grown as a minor crop in most of these areas, with the exception of the Deccan plateau in India where it is grown as a major food source. It is a very hardy crop that is drought tolerant and can survive on marginal soils where other crops may not survive, and can supply 450–900 kg of grain per hectare Kodo millet has large potential to provide nourishing food to subsistence farmers in Africa and elsewhere.



Fig 1: Show the Kodo millet is a monocot and an annual grass that grows to heights of approximately four feet

Kodo millet is a monocot and an annual grass that grows to heights of approximately four feet. It has an inflorescence that produces 4-6 racemes that are 4–9 cm long. Its slender, light green leaves grow to be 20 to 40 centimeters in length. The seeds it produces are very small and ellipsoidal, being approximately 1.5 mm in width and 2 mm in length; they vary in colour from being light brown to a dark grey. Kodo millet has a shallow root system which may be ideal for intercropping. *Paspalum scrobiculatum* var. *scrobiculatum* is grown in India as an important crop, while *Paspalum scrobiculatum* var. *commersonii* is the wild variety indigenous to Africa. The Kodo millet, also known as cow grass, rice grass, ditch millet, Native Paspalum, or Indian Crown Grass originates in tropical Africa, and it is estimated to have been domesticated in India 3000 years ago. The domestication process is still ongoing. In southern India, it is called varaku or Koovaraku. Kodo is probably a corrupt form of kodra, a Hindi name of the plant. It is grown as an annual.

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It is a minor food crop eaten in many Asian countries, primarily in India where in some regions it is extremely important. It grows wild as a perennial in the west of Africa, where it is eaten as a famine food. Often it grows as a weed in rice fields. Many farmers do not mind it, as it can be harvested as an alternative crop if their primary crop fails. In the Southern United States and Hawaii, it is considered to be a noxious weed. Kodo millet is propagated from seed, ideally in row planting instead of broadcast sowing. Its preferred soil type is a very fertile, clay-based soil. Var. *scrobiculatum* is better suited to dried conditions than its wild counterpart, which requires approximately 800–1200 mm of water annually and is well suited to sub-humid aridity conditions. With very low competition from other plants or weeds for nutrients, it can grow well in poor-nutrient soils. However, it does best in soils supplemented with a general fertilizer. The recommended dose for optimal growth is 40 kg of nitrogen plus 20 kg of phosphorus per hectare. A case study in India's Rewa district in 1997 showed a 72% increase in kodo millet grain yields as opposed to no fertilizer. Lodging issues may accompany this. (Please see section

"Other farming issues"). Kodo millet prefers full light for optimal growth, but can tolerate some partial shading. Its ideal temperature for growth is 25–27 °C. It requires four months until maturity and harvesting.

Kodo is an annual tufted grass that grows to 90 cm high. Some forms have been reported to be poisonous to humans and animals, possibly because of a fungus infecting the grain. The grain is enclosed in hard, corneous, persistent husks that are difficult to remove. The grain may vary in color from light red to dark grey. Compared to other small millets, it has a long-crop cycle, ranging from 105 to 120 days. Kodo millet is one of the hardiest among the small millets and grows well in shallow as well as deep soils; it is also adopted to water logged soils. The seeds can remain dormant and be stored for many years. It can produce grain yields of 850 kg/ha without fertilizer and up to 1600 kg/ha with application of N and P.

Seed production methodology

Seed production can be done in June – July. The pollination should not coincide with rains for quality and effective seed setting.

Table 1: Crop improvement and varieties released.

Name of the crop/variety	Year of release	Adaptation Zone	Special features
JK 76	1989	Madhya Pradesh	Earliness
JK 62	1989	Madhya Pradesh	Earliness and high yield
GPUK 3	1991	All states	Yield, earliness and resistance to grain smut
AKP 1	1993	Tamil Nadu	High seed yield
GK 2	1993	Gujarath	--
Vamban – 1 (KMV 20)	1996	Tamil Nadu	--
RBK 155	2000	Madhya Pradesh, Karnataka	Resistant to head smut and shootfly.
JK 48	2001	A.P., M.P., Chattisgarh, Karnataka & Gujarath.	Tolerance to head smut and high grain yield
KK 2	2002	Uttar Pradesh	Resistant to drought and lodging and suitable for saline condition

Field & Seed standards

Kodo millet is a self-pollinated crop. The crop should be raised in isolation. The isolation distance maintained between the varieties is 3 metres for both foundation and certified seed production to maintain the varietal purity. The percentage of

minimum physical purity of certified and foundation seeds should be 97% with a minimum of 75% of germination capacity and 12% of moisture content. The presence of inert matter should not exceed 2.0%.

Table 2: Field standards for seed certification in Kodo millet

Field standards	Foundation seed	Certified seed
Minimum field inspection (number)	3	3
Minimum isolation distance (metres)	3	3
Maximum off-type (%)	0.05	0.10
Maximum objectionable weeds (%)	-	-
Maximum different crop plants (%)	-	-
Maximum objectionable diseases (%)	-	-

Table 3: Seed standards for seed certification in Kodo millet

Seed standards	FS	CS
Minimum physical purity (%)	97	97
Maximum inert matter (%)	3	3
Maximum other distinguishing varieties (number/kg)	-	-v
Maximum other crop seed (number/kg)	10	20
Maximum other weed seed (number/kg)	10	20
Maximum objectionable weeds (number/kg)	-	-
Maximum objectionable diseases (percentage by number)	-	-
Minimum germination (%)	75	75
Maximum moisture (%)		
Ordinary container	12	12
Vapour proof container	8	8

Agronomic principles for seed production: The selected land should be free from volunteer plants. The land should not be cultivated with the same crop in the previous season. Land should be fertile with good drainage facility. Seeds used for seed production should be of good quality certified seeds from an authentic source. Seeds should be healthy with required germination percentage. In North India, sowing should be done in mid June to mid July and in South India during September–December. Recommended seed rate is 4 kg/acre (10 kg/ha). Selected seeds should be treated with *Azospirillum* @ 60 gms/kg of seeds. Treated seeds should be sown with a spacing of 30 x 10 cm. Seeds should be sown at the depth of 3–4 cm. The main field should be ploughed before the onset of monsoon to enable the soil to hold the moisture. At the onset of monsoon field should be ploughed for 2–3 times to make it a fine tilth and formed into ridges and furrows. During final plough apply compost or farmyard manure @ 5 tonnes/acre (12.5 tonnes/ha) and incorporate into the soil. Seeds can be sown in the ridges with a spacing of 30 x 10 cm.

Nutrient management of seed crop: Before final ploughing compost or farmyard manure @ 5 tonnes/acre (12.5 tonnes/ha) should be applied and ploughed into the soil. Instead of this cattle penning can also be practiced. 50 kg neem cake and 500 kg vermin-compost per acre (125 kg neem cake and 1250 kg vermin-compost per hectare) should be applied as basal manure. For rainfed crop, apply 50 kg/acre (125 kg/ hectare) of pungam cake and 250 kg per acre (600 kg / hectare) of vermin-compost as basal manure just before sowing. After first weeding at 20–25 days after sowing top dressing should be done using enriched vermin-compost (2 kg *Azospirillum*, 2 kg *Phospho bacterium* and 2 litres *Panchagavya* mixed with 250 kg vermin-compost and kept covered for a week and then used) @ 250 kg/acre (600 kg/ha). During flower initiation stage 10% tender coconut solution (1 litre tender coconut water + 9 litres of water) should be sprayed. All the above mentioned inputs should be applied to the rain-fed crop only when the soil is wet.

Weed management in seed crop: The seed production field should be maintained weed free from the initial stage. It is essential to control the weeds in the initial stages of plant growth especially upto 35 – 40 days after sowing. Generally two weedings at an interval of 15 days is sufficient. Weeding can be done with hand hoe or wheel hoe in line sown crop. *Kharif* season crop does not require any irrigation, it is mostly grown as a rain-fed crop. In the absence of rains one or two irrigation can be done. During heavy rains the excess water from the field should be drained out.

Roguing & Field inspection: Roguing should be done often to remove the off-types, volunteer plants and diseased plants

from the seed production field to avoid the genetic contamination. Roguing should be done upto the flowering stage. Maximum percentage of off- type permitted at the final inspection is 0.05% for foundation and 0.10% for certified seed production. A minimum of two inspections should be done between flowering and maturity stages by the Seed Certification Officer. The first inspection is done at the time of flowering to check the isolation and off-types and the second done during the maturity stage prior to harvest to check the off-types and to estimate the yield.

Harvesting and seed processing: Harvest is done once the ear heads are physiologically mature. Normally crop is ready for harvest in 100 days. Physiologically mature ear heads will turn from brown to green colour. Plants are cut close to the ground level, bundled and stacked for a week before threshing. The ear heads are threshed by trampling under the feet of bullocks. The threshed grains are further cleaned by winnowing. The cleaned seeds should be sun dried to attain a safe moisture level of 12%. Care should be taken while drying to avoid mechanical injury to the seeds and contamination. Seeds can be stored upto 13 months under proper storage conditions.

Diseases and pests management

Head smut disease is known to be prevalent during some years which is seed borne. Steeping the seeds in 1.5 per cent copper sulphate or dusting with copper carbonate at 6 g/kg of seed are equally effective. Organo mercurial dusts for seed treatment also control the disease. Bavistin 25 SD [carbendazim], Dithane M45 [mancozeb] and Parasol [phenyl mercury acetate] at 2 g/kg seed also give best disease control. Soil application of phorate 1 kg a. i/ha in furrow is effective in checking shoot fly infestation.

Results and Discussion: Table-4 revealed that the total seed production of kodo variety JK-137 was 7.90 q/ha, Barnyard millet varieties CO(KV)2-3.85 q/ha & DHBM 93-3-4.65 Q/ha, Sorghum varieties CSV-27- 0.10 q/ha & CSV-31-0.13 q/ha & Pearl millet variety PC-701-4.55 q/ha. Similar findings were also observed by Sen (1967), Bisalaiah and Patil (1987), Acharya and Agarwal (1989), Shankaran (1994), Sharma and Continoho (2005) & Badal and Singh (2010).

Table 4: Production location: Nauner, Datia.

Crop	Variety	Class	Seed (q)
Kodo	JK137	T/L	7.90
Barnyard	CO(KV)2	T/L	3.85
Barnyard	DHBM93-3	T/L	4.65
Sorghum	CSV27	T/L	0.10
Sorghum	CSV31	T/L	0.13
P. millet	PC701	T/L	4.55
Total			21.18





Conclusion and future prospects

The basic objective of foundation seed production of Sorghum under Seed-Hub on Millets is that to fulfil the seed requirements of the farmers in Bundelkhand region and also uplifting their socio-economic conditions of the farmers through doubling the farm income.

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