'Tank': local land race of wheat for protection of wheat field against monkey raids – an indigenous technical knowledge

Farmers have been nurturing agriculture using their skill and wisdom acquired during the last 12,000 years of cultivation. In this process of domestication, the superior plants in different food crops are selected, cultivated and maintained through local wisdom. In general, farmers engage in conscious and creative practices as they select desirable plants for their crops. In case of cultivated species such as those of food crops that have been in cultivation for centuries, plants with different attributes are selected. This has led to the cultivation and maintenance of a large number of land races. However, in the mid sixties, intensive agriculture linked with the green revolution was largely responsible for the genetic erosion that resulted in the displacement of numerous land races of crop species with improved genotypes. In this process, replacement of traditional agricultural system with commercialized agriculture occurred and farmers' information and experience on the traditional varieties became faded. This phenomenon is more apparent in favourable environments rather than stress and fragile ecosystems (agro-ecosystem in mountain/hills, coastal zone, etc.)[1].

Traditional farming in stress and fragile ecosystems is considered as a natural harbour of biodiversity in general and agri-biodiversity in particular, due to their inaccessibility and less population pressures. The farmers practising traditional farming are generally subsistence farmers. In this way, subsistence farming is non-commercial in nature. Thus, knowledge and practices for managing the crops and natural resources are embedded in the local cultures of the people. Consequently, a great deal of traditional knowledge on the use of crop cultivars is still intact with the indigenous people. This is especially relevant in the mountainous areas such as the Himalayas[2]. The collection of such knowledge is an important event in the conservation of crop diversity.

A classical, indigenous, technical knowledge associated with local land race of wheat, 'Tank', was collected and documented while conducting an exploration in parts of Kumaon Hills. This land race was collected from village Godiadhar, Block Kapkot, Bageshwar District, Uttarakhand (lat. 30°00′N, long. 79°52′E, altitude 1270 m asl) during May 2003. In this area, monkeys (*Macaca mulatta*) and wild pigs (*Sus scrofa*) destroy the standing crops and cause severe economic loss to the farmers. Wild pigs are a serious pest of potato crop, whereas monkeys damage all the crops especially fruits, vegetables and cereals. Monkeys are perceived to be difficult pests to control because of their agility and intelligence. No hunting is permitted for both wild pigs as well as monkeys as they are protected under Wildlife (P.) Act, 1972. Therefore, farmers have developed their own ways and means to protect their crops against monkeys. Based on their experiences, farmers found that land race 'Tank' is not preferred by the monkeys. Therefore, to protect the main wheat crop from damage by monkeys, they grow 'Tank' as the border row and high-yielding varieties in the centre. Thus, whenever monkeys attacks the wheat field, they first eat the spikes of 'Tank' which they dislike; thereby they leave the wheat field.

In this study, we characterized land race 'Tank' along with VL 829 (a popular, improved variety) during rabi 2005–06 at Vivekananda Parvatiya Krishi Anusandhan Sansthan (VPKAS), Experimental Farm, Hawalbagh, Almora, Uttarakhand (29°36′N and 79°40′E and 1250 m asl). 'Tank' showed semi-spreading growth habit, and small and narrow flag leaf (length = 14.9 cm, width = 1.07 cm) compared to VL 829 (length = 18.5 cm, width = 1.4 cm). Tank is tall (140–145 cm) with long and thin peduncle (52.7 cm) compared to VL 829 (35.5 cm; Figure 1 and Table 1). Both Tank and VL 829 mature between 200 and 205 days. Tank exhibited small spike length (9.02 cm), long awns (7.03 cm) and brown glumes. Its grains were small (100 seed weight = 3.17 g), soft (8.7 kg), red in colour, intermediate plumpness, with narrow grain width (2.74 mm) compared to VL 829 (3.45 mm). The protein and

Table 1. Salient characteristics of local land race 'Tank' compared to improved variety VL 829

Character	Tank	VL 829
Coleoptile colour	Purple	Green
Growth class	Semi-spreading	Semi-spreading
Days to 75% spike emergence	145	146
Flag leaf length (cm)	14.91 ± 2.83	18.51 ± 2.70
Flag leaf width (cm)	1.07 ± 0.07	1.4 ± 0.08
Glume colour	Brown	White
Glume pubescence	Absent	Absent
Spike length (cm)	9.02 ± 0.99	11.09 ± 0.36
Number of spikelets per spike	18.2 ± 1.40	22.4 ± 1.35
Peduncle length (cm)	52.7 ± 4.46	35.5 ± 3.62
Awn type	Awned	Awned
Awn length (cm)	7.03 ± 0.55	5.98 ± 0.57
Awn width (mm)	0.51 ± 0.05	0.57 ± 0.16
Awn attitude	Spreading	Oppressed
Number of seeds per spikelet	2–3	3–4
Plant height (cm)	143.3 ± 3.8	113.9 ± 4.95
Days to maturity	204	202
Number of grains per spike	36.8 ± 3.7	47.8 ± 4.20
Grain colour	Red	Amber
Seed plumpness	Intermediate	Plumpy
100 seed weight (g)	3.17 ± 0.20	5.01 ± 0.22
Grain length (mm)	6.63 ± 0.19	6.63 ± 0.22
Grain width (mm)	2.74 ± 0.10	3.45 ± 0.24
Protein (%)	10.1	9.8
Seed hardness (kg)	8.7	11.8
Tannin (mg/100 g catechin equivalent)	23.4	22.8

Figure 1. 'Tank': local land race of wheat.

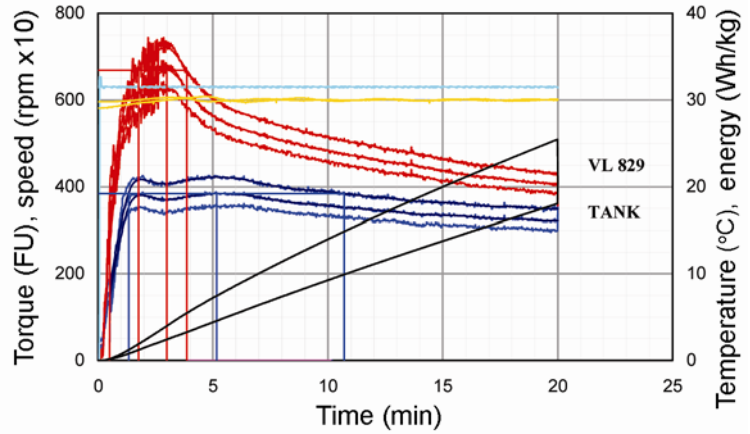

Figure 2. Farinograph analysis of Tank and VL 829.

tannin contents of Tank and VL 829 were comparable.

The farinograph experiment was also conducted in order to find out the dough consistency of local land race 'Tank' and VL Gehun 829. Fifty gram flour at 14% moisture content was mixed with 32.4 ml of cold water (30°C) and the rheological properties were recorded in a farinograph[3] (Doughlab, Newport Scientific, Australia). 'Tank' exhibited strong dough characterized by long development time (5.10 min), high stability (9.23 min), low softening at 12 min (57 Farinograph Unit (FU)) and low mixing tolerance index (34 FU) compared to VL 829 (2.59 min, 2.06 min, 232 FU and 181 FU respectively; Figure 2).

Based on our study, we conclude that because of its long, spreading awns and small and soft grains, the land race Tank is not preferred by the monkeys. The wisdom and experience of hill farmers were used and 'Tank' land race was registered with the National Bureau of Plant Genetic Resources, New Delhi vide INGR Number 06006 (IC 398287). This will help in protecting the national interest on sovereign rights, community rights, biopiracy, unlawful patenting and misuse of native, indigenous plant wealth.

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Dictyopteris serrata (Arschoug) Hyot: first record of male gametophytic plants

The male gametophytic plants of *Dictyopteris serrata* (Arschoug) Hyot have not been reported till date from any part of the world. Gametophytic plants as such in *Dictyopteris* are rarely documented in the literature, due to their infrequent and scanty availability in nature[1–4]. The genus *Dictyopteris* Lamouroux (Dictyotales, Phaeophyceae) comprises a total of 33 species with worldwide distribution, including the tropical and temperate regions[5]. The characteristic features such as flat, ribbon-shaped, dichotomously branched thallus with more or less prominent midrib and presence of rows of meristematic cells at the thallus apex clearly differentiate it from other genera of Dictyotales, namely *Dictyota*, *Dilophus*, *Pachydictyon* and *Spatoglossum*[3]. The Indian Ocean species of *Dictyopteris* has received less attention compared to its allied genus like *Dictyota*, which has been monographed recently[6].

There are about 18 species of *Dictyopteris* reported from the Indian Ocean region, of which six are reported from India[7]. Along Indian waters the genus is unevenly distributed, with maximum species being reported from the north-western coast[8]. In February 2007, we