Proso millet national variety TNAU 202

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Abstract
A superior Proso millet culture, TNAU 202, was bred at the Department of Millets, CPBG, Tamil Nadu Agricultural University, Coimbatore and tested throughout the country for three years (2008 to 2010). Being a profusely tillering, short duration (73 days) culture with better culm strength, it is best suited for the drylands of India. It is a derivative of the cross involving PV 1453 x GPUP 16. It yields on average, 1872 kg/ha of grain and 3700 kg/ha of straw during kharif season. The panicle is loose and branched with more number of grains. The grains are medium bold with desirable grain and cooking qualities. Since it is a short duration crop, it is very well suited for contingency planting. It recorded an increased grain yield of 26.23 and 15.06 per cent over qualifying varieties TNAU 196 and TNAU 201, respectively in All India Coordinated Trials. It recorded 19.16 per cent increased yield over the check TNAU 145, 15.34 per cent over TNAU 151, 31.09 per cent over GPUP 21 and 7.10 per cent as compared to the K1. Hence, TNAU 202 was released for cultivation in different states of the country in the year 2011.

Key words
Proso millet, TNAU 202, grain yield, national variety.

INTRODUCTION
Proso millet or proso (Panicum miliaceum L.) is one of the ancient crops under cultivation. It has been reported to be under cultivation in China from 5000 BC, from where it spread to India, Eurasia and Eastern Europe (La´gler et al., 2005). It is very hardy and is suitable for cultivation in unfavourable conditions. Botanically, proso millet is an annual grass, growing to a height of about 100 cm. The panicle produces seeds of 2-3 mm size which are variously coloured from cream, yellow, orange-red to brown. The grains are highly nutritious with 14.4 per cent protein (Raghavendra Rao et al., 2011) and essential amino acids.

Currently, it is cultivated in India and the CIS countries (former USSR) (Gopalreddy et al., 2007), Afghanistan, Syria, Turkey, Iraq, Iran and Romania (Martín et al., 1976). It is suitable for both tropical and sub-tropical conditions and can be grown at higher elevations of up to 2700 feet (Hussain Sahib, 1997). It is highly adapted to different soil and climatic conditions. It also has the capacity to efficiently convert water to dry matter and grain yield (Theisen et al., 1978, Hulse et al., 1980). The high water use efficiency of the crop is attributed to the short growth period rather than its drought tolerance capacity (Arnon, 1972; Baltensperger, 2002) and is admired for growing as an emergency crop in late seasons (Yegna Narayan Aiyer, 1958). In India, it is cultivated in Tamil Nadu, Orissa, Maharashtra, Karnataka, Andhra Pradesh, Bihar, and Madhya Pradesh with a total area of more than five lakh hectares (Haider, 1997 and Nirmalakumari et al., 2008). In Tamil Nadu, Salem, Villupuram and Vellore is the major proso millet growing districts with a total area of 1000 ha with average productivity of 800 kg/ha.

Since this crop is best suited for contingency planning, the development of an early maturing, high yielding, nutritionally rich drought tolerant variety is essential to ensure nutritional security in the dry land, hill area and...
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tribal farmers. Hence, a breeding work was initiated and a new high yielding national variety, TNAU 202, was developed

MATERIALS AND METHODS

The proso millet variety TNAU 202 was evolved at the Department of Millets, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore. It is a selection from the cross PV 1453 x GPUP 16. Superior single plants with desirable yield contributing features were selected from F$_2$ to F$_5$ generation. In the F$_5$ generation, superior high yielding homozygous progenies were selected and were evaluated for their consistent performance and homozygosity, and the culture TNAU 202 was identified as the best. It was evaluated in replicated trials along with yield checks at the Millet Breeding Station, Coimbatore from 2003 - 2008, in On-farm trials at 79 locations and All India Coordinated Trials from 2008 to 2011 in various parts of the country under ICAR AICSMIP. The reaction of the culture against important pests and diseases was also studied.

| Sl. No | Trial Description               | No. of trials | Grain yield (kg/ha) | Straw yield (kg/ha) |
|--------|--------------------------------|---------------|---------------------|---------------------|
|        | TNAU 202                        |               | TNAU 202            | CO (PV) 5           |
| 1      | Station trials (2003 – 2007)    | 9             | 3157                | 2485                |
| 2      | On farm trials (2008 – 2010)    | 79            | 2635                | 2115                |
|        | Total number of trials          | 88            |                     |                     |
|        | Mean of 88 trials               |               | 2896                | 2300                |
|        | Per cent increase over CO (PV) 5 | 25.9          | --                  | 24.0                |

Table 2. Performance of Proso millet variety TNAU 202 in AICRP trials (2008-2011)

| Particulars | Year   | Number of trials | Proposed Variety | Qualifying Varieties | Checks                        |
|-------------|--------|------------------|------------------|----------------------|------------------------------|
|             |        |                  | TNAU 202         | TNAU 196            | TNAU 201                     |
| Mean Yield across zones (q/ha) | 2008-09 | 6                | 20.35            | 21.08                | 19.58                        |
|             | 2009-10 | 4                | 20.26            | 10.99                | 13.90                        |
|             | 2010-11 | 7                | 15.55            | 12.44                | 15.34                        |
| Mean        |        |                  | 18.72            | 14.83                | 16.27                        |
| Per cent increase over the check and qualifying varieties | 2008-09 |                  | -3.46             | 3.93                 | -                            |
|             | 2009-10 |                  | 84.3             | 45.75                | 34.70                        |
|             | 2010-11 |                  | 25.0             | 1.37                 | -5.13                        |
| Mean        |        |                  | 35.28            | 17.02                | 14.79                        |
| All India Rank | 2008-09 | 2                | 1                | 4                    | -                            |
|             | 2009-10 | 1                | 7                | 5                    | 4                            |
| Frequency in top group | 2008-09 | 4/6              | 2/6              | NA                  | 1/6                          |
|             | 2010-11 | 3/4              | -                | 1/4                 | 4/4                          |
|             |        |                  | 1/7              | 2/7                 | 4/7                          |

RESULTS AND DISCUSSION

In the station trial (Table 1), the culture TNAU 202, recorded an average grain yield of 3157 kg/ha and straw yield of 5570 kg/ha while the check CO (PV) 5 recorded 2485 kg/ha and 4380 kg/ha respectively. On testing the culture in OFT for three years in 79 locations, it was observed to record an average yield of 2635 kg/ha which was a 24.58 per cent increase over CO (PV) 5, the check variety (Table 1). In All India Coordinated trials, the culture was evaluated from 2008 to 2011 in 17 trials laid out in five states viz., Andhra Pradesh, Bihar, Karnataka, Maharashtra and Tamil Nadu. The average yield recorded by the culture was 1872 kg/ha which was a 26.23 and 15.06 per cent increase over TNAU 196 and TNAU
201 (qualifying checks) and 19.16, 15.34, 31.09 and 7.40 per cent increase over the national checks TNAU 145, TNAU 151, GPUP 21 and K 1, respectively (Table 2). It also recorded consistently better performance compared to the qualifying varieties and checks in all the states (Table 3). Proso millet TNAU 202 is tolerant of shoot fly and resistant to rust and brown spot diseases (Table 4). The proso millet variety TNAU 202 completes 50 per cent flowering in 39 days, while the checks TNAU 145, TNAU 151, GPUP 21 and K 1 flowered in 48, 46, 42 and 39 days, respectively. The variety matured in 73 days while the checks TNAU 145, TNAU 151, GPUP 21 and K 1 matured in 79, 78, 75 and 71 days, respectively. It has an upright plant type growing to a height of 75.0 cm and is profusely tillering, producing eight tillers on an average. The panicles are large and branched. It has bold and golden yellow colored grains, with a 1000 grain weight of 3.6 g (Table 5 and Plate 1).

Table 3. Performance of TNAU 202 in different states (grain yield q/ha) (2008 – 2011)

| State            | Proposed variety | Qualifying variety | Check      |
|------------------|------------------|--------------------|------------|
|                  | TNAU 202 | TNAU 196 | TNAU 201 | TNAU 145 | TNAU 151 | GPUP 21 | K 1 |
| Andhra Pradesh   | 18.30     | 19.91   | 17.74   | 14.12    | 13.27    | 15.73   | 27.04 |
| Bihar            | 11.89     | 11.14   | 15.37   | 17.13    | 10.88    | 15.28   | 12.35 |
| Karnataka        | 13.67     | 10.07   | 9.90    | 13.76    | 11.54    | 11.47   | 12.99 |
| Maharashtra      | 5.47      | 4.09    | 5.26    | 4.85     | 4.96     | 5.34    | 4.94  |
| Tamil Nadu       | 42.88     | 32.44   | 37.0    | 31.95    | 38.65    | 28.78   | 34.31 |
| Overall mean (17 trials) | 18.44 | 15.53   | 17.05   | 16.36    | 15.86    | 15.32   | 18.33 |

Percentage increase of TNAU 202 over 18.73 8.15 12.71 16.27 20.35 0.60

Plate 1. Field view of Proso millet TNAU 202
Table 4. Reaction of Proso millet variety TNAU 202 to major pest and diseases

| Sl.No | Pest / Disease          | TNAU 202 | TNAU 196* | TNAU 201* | TNAU 145** | TNAU 151** | GPUP 21** | K1** |
|-------|-------------------------|----------|-----------|-----------|------------|------------|-----------|------|
| Pests |                         |          |           |           |            |            |           |      |
| 1     | Shoot fly (%)           | 50.56    | 47.50     | 53.48     | 85.00      | 83.35      | 52.71     | 54.81 |
| Diseases |                     |          |           |           |            |            |           |      |
| 1     | Rust (Grade)            | 0.44     | 0.73      | 0.81      | 0.50       | 1.00       | 0.67      | 0.00  |
| 2     | Brown spot (grade)      | 0.00     | 0.22      | 0.34      | 0.17       | 0.80       | 0.34      | 0.00  |
| 3     | Leaf blight (grade)     | 5.0      | 4.0       | 5.0       | 4.0        | 4.0        | 5.0       | -     |
| 4     | Leaf blight severity (%)| 65.50    | 36.80     | 48.00     | 37.60      | 32.80      | 41.60     | -     |

* Qualifying varieties , ** National Checks

Table 5. Salient features of Proso millet variety TNAU 202

| S.No. | Character                     | TNAU 202 |
|-------|-------------------------------|----------|
| 1.    | Days to 50% flowering         | 36-41    |
| 2.    | Days to maturity              | 72-75    |
| 3.    | Plant height (cm)             | 64-98    |
| 4.    | No. of productive tillers     | 5-11     |
| 5.    | Leaf of flag length (cm)      | 15-30    |
| 6.    | Width of flag leaf (cm)       | 0.75 – 1.34 |
| 7.    | Length of peduncle (cm)       | 7.0 – 9.5 |
| 8.    | Panicle exertion (cm)         | 3.5 – 6.5 |
| 9.    | Length of inflorescence (cm)  | 22.5 – 28.5 |
| 10.   | Grain yield per plant (g)     | 7.8 – 15.6 |
| 11.   | Straw yield per plant (g)     | 10.0 – 23.0 |
| 12.   | Harvest index                 | 0.28 – 0.34 |
| 13.   | 1000 grain weight (g)         | 3.0 – 3.8 |
| 14.   | Plant habit                   | Erect    |
| 15.   | Plant pigmentation at flowering | Green   |
| 16.   | Blade pubescence              | Medium   |
| 17.   | Sheath pubescence             | Medium   |
| 18.   | Degree of lodging at maturity | Slight   |
| 19.   | Senescence                    | Partial drying at maturity |
| 20.   | Inflorescence compactness     | Open and loose |
| 21.   | Fruit colour                  | Yellow   |
| 22.   | Grain shape                   | Oval     |
| 23.   | Seed size                     | Medium bold |
| 24.   | Milling percentage            | 76.8     |

Based on the above superior performances of the culture TNAU 202 over the qualifying varieties (TNAU 196 and TNAU 201) and national checks (TNAU 145, TNAU 151, GPUP 21 and K 1), it was released as a national variety, by the All India Coordinated Small Millets Improvement Project in the year 2011 for cultivation in India.

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