**A High yielding, Short duration, Non – lodging and Drought tolerant
New Prosomillet variety ATL 2 (TNPm238)**

Dr. M.Vaithiyalingan, Dr. A. Nirmalakumari, Dr. A. Subramanian and Dr. A. Thanga Hemavathy\*

Centre of Excellence in Millets, Tamil Nadu Agricultural University, Athiyandal – 606 603

 Tiruvannamalai, Tamil Nadu

**\*- author for correspondence;** **hemavathytnau@gmail.com**

A high yielding and early maturing prosomillet culture TNPm 230 was developed at the Centre of excellence, Athiyandal, Tamil Nadu Agricultural University and released TNPm 238 as ATL2. It is a pure line selection from IPM 19. It yields on an average grain yield of 2140 kg/ha and straw yield of 2793 kg/ha under rainfed condition. The yield superiority has been observed as 16.24 and 16.68 per cent increase in terms of grain and 18.80 and 19.35 per cent increase in terms of straw yield over the check varieties, CO(PV) 5 and ATL 1 respectively. Panivaragu culture TNPm238 has strong and sturdy culm with large, semi-compact and branched panicles. The plant stature is medium tall and tufty. It is drought tolerant. It is endured with special attributes like easy threshability, synchronized maturity and non-lodging growth habit. The grains are bold and attractive straw yellow in colour. The grains are nutritious (Protein 12.9 %) with preferred grain qualities for cooking and value addition. The nutrient rich straw is palatable and highly suitable for cattle feeding. With high milling out turn (72%), the proposed variety is preferred by consumers and entrepreneurs. In view of stable yield performance across seasons and locations and special attributes with drought tolerance, the Panivaragu culture TNPm238 is proposed for release as ATL 2 to fulfill the long felt need of the dry lands areas in Coimbatore, Erode, Namakkal, Salem, Dharmapuri, Krishnagiri, Thiruvannamalai, Theni, Thoothukudi and Tirunelveli districts of Tamil Nadu where Panivaragu is predominantly grown under rainfed condition.

(Keywords: Prosomillet, drought tolerant, non lodging, short duration, new variety)

**Introduction**

Prosomillet (Panivaragu) as a member of sub-family Panicoideae of the family Poaceae, Panivaragu (*Panicum miliaceum*) is widely cultivated as a cereal across the India, Nepal, Western Burma, Sri Lanka, Pakistan and South East Asian countries. It is grown both in the tropics and sub-tropics and even at an altitude of 2700 feet (Haider, Z.A. (1997).). The crop is hardy and provides a reasonable harvest even in degraded soils under unfavourable weather conditions. Nutritionally the grains are comparable or even superior to major cereals. (Kalinova and Moudry, [2006](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4371761/#B88)). Prosomillet offers a resilient, nutritious crop in the face of climate change. The grain protein is rich in essential amino acids. Prosomillet is a warm season grass and highly nutritious cereal grain used for human consumption, bird seed, and/or ethanol production. Unique characteristics, such as drought and heat tolerance, make proso millet a promising alternative cash crop (Nirmalakumari A. *et al* 2008). Nutritional analyses of Proso millet varieties and other minor crops are tools to encourage farmers and growers to cultivate them and for consumers to integrate these crops in the diet. There is a need to develop the proso millet varieties adapted to dryland farming regions of India could give growers a much-needed option for diversifying their predominantly under cropping systems. With this objective breeding work was initiated and a new high yielding variety TNPm 238 as ATL 2 was developed to increase the production and productivity of prosomillet in Tamil Nadu and India where Panivaragu is grown predominantly under double- cropped rainfed situation.

**Materials and Methods**

 The prosomillet culture TNPm 238 was evolved at Centre of excellence, Athiyandal, Tamil Nadu Agricultural University and released as ATL 2. It is a pure line selection from IPM 19. Elite plants with desirable characters which contribute towards high grain yield were selected and forwarded. They were evaluated for their sustained performance, homozygosity and the culture TNPm 238 was identified as the best. The culture was evaluated from 2018-19 under Coordinated Varietal Trials. TNPm 238 was evaluated under different trials *viz.,* station trials, Multi Location Trials and On-farm trials during 2012-2022. Besides the reaction of the culture against important pests and diseases were also screened. Based on the standard procedures the grain qualities and its acceptability were also analyzed.

**Results and Discussion**

The overall performance of the Prosomillet culture TNPm 238 in several trials was presented in Table 1. A total of 253 trails were conducted from 2012 to 2022. It yields on an average grain yield of 2140 kg/ha and straw yield of 2793 kg/ha under rainfed condition. The yield superiority has been observed as 16.24 and 16.68 per cent increase in terms of grain and 18.80 and 19.35 per cent increase in terms of straw yield over the check varieties, CO (PV) 5 and ATL 1 respectively.

State trials were conducted during *kharif* 2012-16, the culture recorded a mean grain yield of 2487 kg/ha with 19.62% increase over CO(PV) 5 and mean straw yield of 3761 kg/ha which is 40.49% more yield than CO (PV) 5 (Table 1). Adaptive Research Trials were conducted over 175 locations, ATL 2 variety recorded more than 15% grain yield compared with check varieties CO(PV)5 and ATL 1 and recorded 2936 kg of straw yield /ha which is more than 17% compared with CO(PV) 5 and ATL 1 (Table 1).

Panivaragu culture TNPm238 has given 8.66 and 10.50 per cent increased grain and straw yield at 125% of RDF over 100% RDF respectively. At the same time per cent loss at 75% of RDF is 3.98 and 8.13 only for grain and straw yield in comparison to 100% RDF. Whereas, the Checks, ATL 1 and CO(PV) 5 have shown 5.13 and 9.02; 8.99 and 10.07 % reduction in grain and straw yield respectively.(Table 2).

The performance of yield contributing traits was presented in Table 3. The profusely tillering and non-lodging culture is highly suitable for drylands of India. The panicle is large, semi-compact and branched.

Prosomillet culture TNPm 238 general there is no major incidence of diseases. However, Panivaragu culture TNPm238 recorded less incidence of brown spot and leaf blight incidence when compared with the check varieties TNAU 164 and TNAU 151 under controlled condition. (Table 4).

Prosomillet culture TNPm 238 In general there is no major incidence of pests. However, Panivaragu culture TNPm238 recorded less dead heart symptom due to Shootfly incidence when compared with the check varieties TNAU 164 and TNAU 151 under field condition. (Table 5).

Regarding grain quality characteristics, Panivaragu culture TNPm238 excels the check varieties ATL 1 and CO (PV) 5. TNPm 238 was found to be the best during cooking and sensory evaluation. TNAU 238 was found to be the best during cooking and sensory evaluation (Table 6). The grains are also nutritionally superior and bold and golden yellow in colour.

In view of stable yield performance across seasons and locations and special attributes, with drought tolerance, the Prosomillet culture TNPm 238 is recommended for state release by SVRC during 2022, TNPm 238 as ATL 2 to ensure the nutritional security of small farmers in All India level.

**References**

Haider, Z.A. (1997). Little millet in Indian Agriculture: Progress and perspectives. In : Extended summaries of National Seminar on Small millets organized by Indian Council of Agricultural Research and Tamil Nadu Agricultural University held at Tamil Nadu Agricultural University, Coimbatore during 23-24, April 1997. pp. 5-6.

Kalinova J., Moudry J. (2006). Content and quality of protein in proso millet (Panicum

 miliaceum L.) varieties. *Plant Foods Hum. Nutr*. 61, 45–49. 10.1007/s11130-006-0013-9

Nirmalakumari A., Sumathi P., Joel A. J., Kumaravadivel N., Senthil N., Devan P., (2008). A

 high yielding and early maturing panivaragu variety CO (PV) 5. *Madras Agric. J*. 95, 1–6.

# Table 1. Overall performance of Panivaragu culture TNPm 238

|  |  |  |  |
| --- | --- | --- | --- |
| **Name of the Trials** | **No. of trials** | **Grain Yield (kg/ha)** | **Straw Yield (kg/ha)** |
| **TNPm 238** | **CO(PV) 5\*** | **ATL 1\*** | **TNPm 238** | **CO(PV) 5\*** | **ATL 1\*** |
| Station Trials(2012-2016) | 7 | 2487 | 2079 (19.62%) |  | 3761 | 2677(40.49%) | - |
| MLT(2016-2018) | 8 | 1933 | 1753(10.27%) | - | 1933 | 1753(10.27%) | - |
| ART(2018-2020) | 175 | 2078 | 1807(15.00%) | 1799 (15.51%) | 2716 | 2321(17.02%) | 2311(17.52%) |
| On Farm Trials(2018-2022) | 55 | 2302 | 1924 (19.60%) | 1929 (19.33%) | 2936 | 2413(21.67%) | 2415(21.57%) |
| Large Scale Demonstrations(2018-22) | 8 | 2296 | 1904 (20.5%) | 1954 (17.5%) | 2966 | 2449(21.11%) | 2454(20.86%) |
| **Mean (253 trials)** | **2140** | **1841** | **1834** | **2793** | **2351** | **2340** |
| **% increase over** | **-** | **16.24%** | **16.68%** | **-** | **18.80%** | **19.35%** |

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**Table 2. Fertilizer Response TNPm238 in AICRP – Small Millets Trial (2018-19)**

|  |  |
| --- | --- |
| Name of proposed variety: **TNPm 238** | Adaptability Zone: Tamil Nadu |
| Production condition: Rain-fed |
| Name of Expt. | Item | Fertilizer dose | Proposed Variety | National Check |
| **TNPm 238** | **ATL 1**\* | **CO (PV) 5**\* |
| **Grain** | **Straw** | **Grain** | **Straw** | **Grain** | **Straw** |
| Fertilizer experiment | Yield (kg/ha) under recommended dose | 100% RDF | 1756 | 2103 | 1558 | 2006 | 1334 | 1768 |
| Percentage gain or loss under other doses | 75% RDF | 1686 | 1871 | 1478 | 1825 | 1214 | 1574 |
| % Loss | 3.98 | 8.13 | 5.13 | 9.02 | 8.99 | 10.97 |
| 125% RDF | 1908 | 2324 | 1675 | 2178 | 1432 | 1897 |
| % Gain | 8.66 | 10.50 | 8.34 | 7.50 | 7.34 | 7.30 |

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**Table 3. Salient Features of Panivaragu culture TNPm238**

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Character** | **TNPm238** |
| **Range** | **Mean** |
| 1 | Days to 50% flowering | 28-33 | 35 |
| 2 | Days to maturity | 65-73 | 70 |
| 3 | Plant height (cm) | 91-97 | 94 |
| 4 | Number of productive tillers | 6-10 | 8 |
| 5 | Flag leaf length (cm) | 22.3-25.2 | 23.8 |
| 6 | Flag leaf width (cm) | 2.3-2.7 | 2.5 |
| 7 | Length of inflorescence (cm) | 31.5-36.2 | 32.0 |
| 8 | Grain yield per plant (g) | 6.6-8.0 | 7.3 |
| 9 | Straw yield per plant (g) | 18-32 | 23.0 |
| 10 | Harvest index | 0.32-0.37 | 0.34 |
| 11 | 1000 grain weight (g) | 6.1-6.7 | 6.3 |
| 12 | Plant habit | Erect |
| 13 | Plant pigmentation at flowering | Absent |
| 14 | Culm branching | Present |
| 15 | Degree of lodging at maturity | Low |
| 16 | Inflorescence shape | Diffused |
| 17 | Shattering of inflorescence | Absent |
| 18 | Grain colour | Straw white |
| 19 | Grain shape | Oval |
| 20 | Grain size | Bold |
| 21 | Milling percentage | 72.0 |

**Table 4. Disease reaction of Panivaragu culture TNPm 238 under sick plot condition**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No.** | **Entries** | **Leaf blight (G)** | **Brown spot (G)** |
| 1 | TNPm 238 | 4.17 | 2.67 |
| 2 | TNAU 164\* | 4.67 | 2.90 |
| 3 | TNAU 151\* | 5.13 | 2.90 |
| 4 | TNPm 230 (R)\* | 4.33 | 2.00 |
| 5 | Nilavoor local (S)\* | 7.00 | 3.00 |

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**Disease rating scale for leaf blight and brown spot**

|  |  |  |
| --- | --- | --- |
| **Score** |  | **Disease reaction** |
| 1 | - | Highly resistant (HR) |
| 2-3 | - | Resistant (R) |
| 4-5 | - | Moderately resistant (MR) |
| 6-7 | - | Susceptible (S) |
| 8-9 | - | Highly susceptible (HS) |

**Table 5. Pest reaction of Panivaragu culture TNPm238 under field condition**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No.** | **Entries** | **Shoot fly****(% deadheart @ 21 DASE)** | **Shoot fly****(% deadheart @ 28 DASE)** |
| 1 | TNPm 238 | 23.48 | 30.97 |
| 2 | TNAU 164\* | 24.08 | 32.03 |
| 3 | GPUP 24 (R) \* | 18.24 | 19.61 |
| 4 | TNAU 151 (S) \* | 27.82 | 36.35 |

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**Rating of shootfly tolerance based on percent dead hearts caused by shoot fly attack.**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No.** | **Level of tolerance** | **Score** | **Percent deadheart** |
| 1. | Highly tolerance | 1 | <10% infestation |
| 2. | Tolerant | 3 | 10-20% infestation |
| 3. | Moderately tolerant | 5 | 20-35% infestation |
| 4. | Susceptible | 7 | 35-50% |
| 5. | Highly Susceptible | 9 | > 50% infestation |

**Table 6. Grain and quality characteristics of Panivaragu culture TNPm238**

| **S.No** | **Quality characteristics** | **TNPm 238** | **ATL 1\*** | **CO(PV) 5\*** |
| --- | --- | --- | --- | --- |
|  | **Parameters** |  |  |
| **a)** | **Nutritional Quality** |  |  |
| 1 | Protein ( g/100g) | **12.9** | 12.5 | 12.8 |
| 2 | Carbohydrate(g /100g) | **70.4** | 71.7 | 72.3 |
| 3 | Oil (g/100g) | **3.3** | 3.4 | 3.6 |
| 4 | Crude fiber (g/100g) | **7.5** | 7.3 | 7.1 |
| 5 | Mineral matter (g/100g) | **2.7** | 2.1 | 2.3 |
| 6 | Potassium (g/100g) | **2.2** | 1.8 | 2.0 |
| 7 | Phosphorus (mg/100g) | **210** | 205 | 209 |
| 8 | Calcium (mg/100g) | **17.1** | 15.6 | 16.5 |
| 9 | Iron (mg/100g) | **3.6** | 3.2 | 3.3 |
| 10 | β-carotene (μg/g) | **127** | 110 | 115 |
| 11 | 1000 grain weight (g) | **6.3** | 5.8 | 5.9 |
| 12 | 1000 grain volume (ml) | **7.0** | 6.2 | 6.3 |
| **b)** | **Cooking Quality** |  |
| 1 | Water uptake (ml) | **963** | 945 | 950 |
| 2 | Cooking time (min) | **25** | 26 | 27 |
| 3 | Initial Volume (ml) | **114** | 100 | 100 |
| 4 | Cooked volume (ml) | **796** | 710 | 740 |
| 5 | Initial weight (g) | **100** | 100 | 100 |
| 6 | Cooked weight (g) | **786** | 700 | 725 |
| **c)** | **Sensory evaluation score (1-10 score)** |  |
| 1 | Colour&Appearance | **9.5** | 8.0 | 9.0 |
| 2 | Flavour | **9.5** | 8.5 | 9.0 |
| 3 | Texture | **9.5** | 8.0 | 9.0 |
| 4 | Taste | **9.5** | 8.5 | 9.0 |
| **d)** | **Fodder Characteristics** |  |
| 1 | Dry matter (%) | **23.81** | 20.56 | 21.43 |
| 2 | Crude protein (%) | **7.97** | 6.95 | 7.02 |
| 3 | Crude fibre (%) | **18.16** | 20.68 | 19.53 |
| 4 | Potassium (%) | **2.87** | 3.10 | 2.95 |
| 5 | Phosphorus (%) | **0.20** | 0.15 | 0.18 |
| 6 | Mineral matter (%) | **4.31** | 3.10 | 3.15 |
| **e)** | **Milling per cent** | **72.0** | 69.5 | 67.8 |

Source: Community Science College and Research Institute, TNAU, Madurai &Department of Forage Crops, TNAU, Coimbatore.