

‘TAMC 101’: New Organic Cover Crop and Forage Cowpea for the Southern United States

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Cowpea [*Vigna unguiculata* (L.) Walp.] ($2n = 2x = 22$) is a diploid summer legume (Ravelombola et al. 2018). Integrating legumes such as cowpea as a cover crop or green manure into an organic cropping system contributes to soil fertility (Agbicodo et al. 2010; Ravelombola et al. 2018; Rühlemann and Schmidtke 2015). This management practice solves, in part, N deficiency in organic croplands (de Freitas et al. 2012). The use of a cover crop legume is an effective tool for weed suppression in organic farming systems (Brennan and Smith 2005). Cowpea is also adapted to organic dryland production systems because it is drought and heat tolerant (Ravelombola et al. 2019, 2022). Issues in adopting cover crops include planting and management costs, depletion of soil moisture, risk of increased weed pressure if the plant stand is poor, and cover crop termination (Han and Niles 2023). These issues can be exacerbated in organic farming systems, in which the use of chemical herbicides to end cover crops is not allowed (Ravelombola et al. 2025). However, cowpea can be ended by the first freeze, which is an alternative for crop termination. In addition, cowpea is a drought-tolerant crop, which does not affect soil moisture significantly (Perrino et al. 1993; Ravelombola et al. 2019). Dry sowing is common in dryland production management systems. In this context, cowpea has advantages because seeds can germinate and plants can emerge under minimal water conditions. Cowpea is a low-input crop, which can reduce costs pertaining to field management. Organic

‘TAMC 101’ was developed to diversify the source of organic forage and cover crop legumes for the southern United States. Therefore, ‘TAMC 101’ is critical in addressing the lack of organic forage and cover crops in the region.

Origin

Organic ‘TAMC 101’ originated from a single plant selection from the extremely variable PI 293587 introduced in the United States in 1963. The origin of this PI is unknown. A single plant with a significant aboveground biomass production was noted from PI 293587. Seeds of the selected single plant were increased in the organic plot at the Texas A&M AgriLife Research and Extension (Vernon, TX, USA) and stored at the Texas A&M AgriLife Foundation Seed Service.

Description

Organic ‘TAMC 101’ has a semiprostrate growth habit, with purple flowers. It has a globose-shaped seed with a smooth, brown seedcoat and a cream eye. It has green hypocotyls and a strong main stem. The leaves are an intermediate green, with an intermediate texture (Fig. 1). The plants covered the soil surface rapidly compared with the check used in our study. This assisted with weed control and suppression in our organic farming system. Field trials of organic ‘TAMC 101’ were conducted from 2021–23 on organic plots in two locations: the Texas A&M AgriLife Research and Extension, and on farmers’ collaborator organic plots in Lubbock, TX, USA. At each location, the experimental unit was defined as a four-row plot that was 10 m long, with a 1 m row spacing and a 10 cm plant spacing within each row. Weeds were removed mechanically using a cultivator sweep. Dry matter (DM) yield was calculated by harvesting plants from the two middle rows from each experimental unit. A 500 g aboveground biomass sample

from the two outside rows of each experimental unit was ground using a Thomas-Wiley Laboratory Mill Model 4 grinder (Arthur H. Thomas Co, Philadelphia, PA, USA) and was screened to pass through a 2 mm sieve. Ground biomass samples were sent to the Texas A&M AgriLife Extension Service Soil, Water, and Forage Testing Laboratory (College Station, TX, USA) for total N analysis. The 500 g aboveground biomass sample from the two outside rows of each experimental unit was also used for forage quality analysis, which consisted of determining crude protein (CP), acid detergent fiber (ADF), and neutral detergent fiber (NDF). Forage analysis was conducted using a DA 7250 analyzer (PerkinElmer Health Sciences Canada Inc, Winnipeg, Manitoba, Canada). Data were analyzed using analysis of variance and were run in JMP Genomics® v. 7 (SAS Institute, Inc, Cary, NC, USA). Mean separation analysis was conducted using Fisher’s protected least significant difference at $\alpha = 0.05$, and data were also run in JMP Genomics® v (SAS Institute, Inc).

Table 1 shows the agronomic performance of both ‘TAMC 101’ and the ‘Iron & Clay’ check across locations and throughout the years of the study. These agronomic characteristics consist of DM, aboveground N accumulation (ANA), CP, ADF, and NDF. For the combined DM across locations and over years, DM of ‘TAMC 101’ ($4315 \text{ kg}\cdot\text{ha}^{-1}$) was significantly greater than the DM of the ‘Iron & Clay’ check ($3906 \text{ kg}\cdot\text{ha}^{-1}$). For both varieties, the highest DM values were recorded during the 2022 season in Vernon, TX, USA, where the DM of ‘TAMC 101’ and the ‘Iron & Clay’ check were 6481 and $5343 \text{ kg}\cdot\text{ha}^{-1}$, respectively. The lowest DM values were recorded for the 2021 season in Lubbock, TX, USA, where the DM of ‘TAMC 101’ and the ‘Iron & Clay’ check were 3432 and $2784 \text{ kg}\cdot\text{ha}^{-1}$, respectively. For all location-year–environment combinations, the DM of ‘TAMC 101’ was significantly greater than DM of the ‘Iron & Clay’ check.

The ANA of ‘TAMC 101’ ($83.4 \text{ kg}\cdot\text{ha}^{-1}$) was significantly greater than the ANA of the ‘Iron & Clay’ check ($78.6 \text{ kg}\cdot\text{ha}^{-1}$). The highest ANA values were recorded during the 2022 season in Vernon, TX, USA, where the ANA of ‘TAMC 101’ and the ‘Iron & Clay’ check

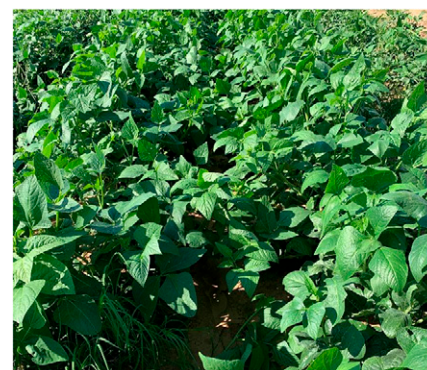


Fig. 1. Biomass of organic ‘TAMC 101’.

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Table 1. Agronomic characteristics of organic ‘TAMC 101’ and ‘Iron & Clay’ cowpea in field trials from 2021–23.

Year, location, cultivar	Dry matter (kg·ha ⁻¹)	Aboveground N accumulation (kg·ha ⁻¹ N)	Crude protein (%)	Acid detergent fiber (%)	Neutral detergent fiber (%)
2021					
Vernon					
TAMC 101	4125 a ⁱ	92.6 a	21.7	38.2	39.6
Iron & Clay	3189 b	78.8 b	22.2	35.4	41.7
CV (%)	18.1	11.4	1.6	5.4	3.6
LSD: <i>P</i> = 0.05	715	10.3	NS	NS	NS
Lubbock					
TAMC 101	3432 a	71.3	20.1	37.8	40.2
Iron & Clay	2784 b	63.5	23.5	39.5	43.5
CV (%)	14.7	8.2	11.1	3.1	5.5
LSD: <i>P</i> = 0.05	529	NS	NS	NS	NS
2022					
Vernon					
TAMC 101	6481 a	97.9 a	21.4	31.8	39.6 a
Iron & Clay	5343 b	82.3 b	19.2	29.6	32.7 b
CV (%)	13.6	12.2	7.7	5.1	13.5
LSD: <i>P</i> = 0.05	613	12.8	NS	NS	5.9
Lubbock					
TAMC 101	5037 a	91.3	22.7	32.7	39.5
Iron & Clay	4345 b	88.5	24.5	31.4	37.9
CV (%)	10.4	2.2	5.4	2.9	2.9
LSD: <i>P</i> = 0.05	601	NS	NS	NS	NS
2023					
Vernon					
TAMC 101	5235 a	86.9 a	23.1	30.5	34.8 b
Iron & Clay	4132 b	73.4 b	20.6	33.2	40.5 a
CV (%)	16.6	11.9	8.1	5.9	10.7
LSD: <i>P</i> = 0.05	538	10.4	NS	NS	4.3
Lubbock					
TAMC 101	4038 a	89.5	21.8	31.3	34.9
Iron & Clay	3643 b	85.1	23.5	35.2	37.1
CV (%)	7.3	3.6	5.3	8.3	4.3
LSD: <i>P</i> = 0.05	362	NS	NS	NS	NS
Average					
TAMC 101	4315 a	83.4 a	22.1	33.8	38.5
Iron & Clay	3906 b	78.6 b	22.2	34.1	38.9
CV (%)	7.1	4.2	0.4	0.6	0.7
LSD: <i>P</i> = 0.05	389	4.1	NS	NS	NS

ⁱMeans followed by the same letter are not significantly different using a protected LSD at $\alpha = 0.05$.

CV = coefficient of variation; LSD = least significant difference.

NS Nonsignificant at $P < 0.05$.

were 97.9 and 82.3 kg·ha⁻¹, respectively. The lowest ANA values was recorded for the 2021 season in Lubbock, TX, USA, where the ANA of ‘TAMC 101’ and the ‘Iron & Clay’ check were 71.3 and 63.5 kg·ha⁻¹, respectively.

The average amount of CP of ‘TAMC 101’ (22.1%) was not significantly different from the CP amount of the ‘Iron & Clay’ check (22.2%). Overall, the amount of CP varied from 20.1% to 24.5%, depending on location and year. However, the CP of both varieties was not significantly different regardless of the location–year–environment combination. These results indicate that ‘TAMC 101’ can be as competitive as the ‘Iron & Clay’ check in terms of CP.

The average amount of ADF of ‘TAMC 101’ (33.8%) was not significantly different from that of the ‘Iron & Clay’ check (34.1%). The ADF varied from 30.5% to 39.5%, depending on location and year. The average NDF of ‘TAMC 101’ (38.5%) was not significantly different from that of ‘Iron & Clay’ check (38.9%). The NDF varied from 32.7% to 43.5%.

Availability

Prospective licensees’ requests should be addressed to Richard Vierling via richard.vierling@ag.tamu.edu.

References Cited

- Agbicodo EM, Fatokun CA, Bandyopadhyay R, Wydra K, Diop NN, Muchero W, Ehlers JD, Roberts PA, Close TJ, Visser RGF, van der Linden CG. 2010. Identification of markers associated with bacterial blight resistance loci in cowpea [*Vigna unguiculata* (L.) Walp]. *Euphytica*. 175(2):215–226. <https://doi.org/10.1007/s10681-010-0164-5>.
- Brennan EB, Smith RF. 2005. Winter cover crop growth and weed suppression on the central coast of California. *Weed Technol*. 19(4): 1017–1024. <https://doi.org/10.1614/WT-04-246R1.1>.
- de Freitas ADS, Silva AF, de Sá Barretto Sampaio EV. 2012. Yield and biological nitrogen fixation of cowpea varieties in the semi-arid region of Brazil. *Biomass Bioenergy*. 45: 109–114. <https://doi.org/10.1016/j.biombioe.2012.05.017>.
- Han G, Niles MT. 2023. An adoption spectrum for sustainable agriculture practices: A new framework applied to cover crop adoption. *Agric Sys*. 212:103771. <https://doi.org/10.1016/j.agry.2023.103771>.
- Perrino P, Laghetti G, Spagnoletti Zeuli PL, Monti LM. 1993. Diversification of cowpea in the Mediterranean and other centres of cultivation. *Genet Resour Crop Evol*. 40(3):121–132. <https://doi.org/10.1007/BF00051116>.
- Ravelombola W, Manley A, Stephens S. 2025. ‘TAMG 101’ and ‘TAMG 102’: New organic guar for the southern United States. *HortScience*. 60(11):1957–1958. <https://doi.org/10.21273/HORTSCI118007-24>.
- Ravelombola W, Qin J, Weng Y, Mou B, Shi A. 2019. A simple and cost-effective approach for salt tolerance evaluation in cowpea (*Vigna unguiculata*) seedlings. *HortScience*. 54(8): 1280–1287. <https://doi.org/10.21273/HORTSCI14065-19>.
- Ravelombola W, Shi A, Huynh B-L, Qin J, Xiong H, Manley A, Dong L, Olaoye D, Bhattarai G, Zia B, Alshaya H, Alatawi I. 2022. Genetic architecture of salt tolerance in a multi-parent advanced generation inter-cross (MAGIC) cowpea population. *BMC Genomics*. 23(1):100. <https://doi.org/10.1186/s12864-022-08332-y>.
- Ravelombola W, Shi A, Weng Y, Mou B, Motes D, Clark J, Chen P, Srivastava V, Qin J, Dong L, Yang W, Bhattarai G, Sugihara Y. 2018. Association analysis of salt tolerance in cowpea (*Vigna unguiculata* (L.) Walp) at germination and seedling stages. *Theor Appl Genet*. 131(1):79–91. <https://doi.org/10.1007/s00122-017-2987-0>.
- Rühlemann L, Schmidtke K. 2015. Evaluation of monocropped and intercropped grain legumes for cover cropping in no-tillage and reduced-tillage organic agriculture. *Eur J Agron*. 65:83–94. <https://doi.org/10.1016/j.eja.2015.01.006>.