**Special Supplement: Pulses**

# Morphoagronomic variability of traditional cowpea varieties in Western Amazon[1]

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## ABSTRACT

Despite the vast collection of cowpea genetic resources available, there is still little information about the local varieties and their ecophysiological and morphophysiological differences. The present study aimed to describe and classify landrace cowpea varieties with agronomic potential for the Rondônia state, Brazil. The experiment was conducted under field conditions, using a randomized block arrangement, with twenty-four traditional cowpea accessions and two replicates. The high diversity of grain color found in the cowpea accessions (83.31 % colored, 12.50 % white and 4.16 % black), combined with the wide morphological variability in other descriptors, confirms that the northern region is an important center for on-farm conservation of the species. The cowpea accessions with indeterminate (IFTO-PA 03, IFTO-PA 14 and IFTO-PA 15) and determinate (IFTO-PA 08, IFTO-PA 12, IFTO-PA 13, IFTO-PA 16 and IFTO-PA 17) growth habit, with average flowering time of 45.12 days, showed equivalent and favorable agronomic performances under the local edaphoclimatic conditions, and are indicated for incorporation into family-based production systems and mechanized agriculture.

KEYWORDS: *Vigna unguiculata*, landrace cowpea varieties, morphological descriptors.

## RESUMO

Variabilidade morfoagronômica de variedades tradicionais de feijão-caupi na Amazônia Ocidental

Apesar do vasto acervo de recursos genéticos de feijão-caupi disponível, ainda há pouca informação sobre as variedades locais e suas diferenças ecofisiológicas e morfofisiológicas. Objetivou-se descrever e classificar variedades crioulas de feijão-caupi com potencial agronômico para o estado de Rondônia. O experimento foi conduzido em condições de campo, utilizando-se arranjo de blocos casualizados, com vinte e quatro acessos tradicionais de feijão-caupi e duas repetições. A alta diversidade de cores de grãos encontrada nos acessos de feijão-caupi (83,31 % coloridos, 12,50 % brancos e 4,16 % pretos), combinada à ampla variabilidade morfológica em outros descritores, confirma que a região Norte é um importante centro de conservação "on farm" da espécie. Os acessos de feijão-caupi de hábito de crescimento indeterminado (IFTO-PA 03, IFTO-PA 14 e IFTO-PA 15) e determinado (IFTO-PA 08, IFTO-PA 12, IFTO-PA 13, IFTO-PA 16 e IFTO-PA 17), com média de florescimento de 45,12 dias, apresentaram desempenhos agronômicos equivalentes e favoráveis nas condições edafoclimáticas locais, e são indicados para a incorporação em sistemas de produção de base familiar e agricultura mecanizada.

PALAVRAS-CHAVE: *Vigna unguiculata*, variedades crioulas de feijão-caupi, descritores morfológicos.

## INTRODUCTION

Cowpea [*Vigna unguiculata* (L.) Walp.] is a crop that plays a crucial role in human and animal nutrition in several countries (Chen et al. 2017a), being an important source of food for populations in Asia, Africa and Latin America (Tan et al. 2012, Chen et al. 2017b).

In Brazil, it is estimated that there is a planted area of 1.26 thousand hectares, with production of 636.2 thousand tons of cowpea (Conab 2025), which allows the crop to be among the main legumes cultivated in the North and Northeast regions, and an excellent source of proteins and minerals (Araújo et al. 2021). In addition, due to its ability to adapt to different ecosystems, the crop has stood out as an alternative for summer cultivation in other Brazilian regions, since it can be used as an option in crop rotation (Araújo et al. 2021).

In the North region, cowpea cultivation represents a viable economic alternative for traditional communities and family farmers, mainly

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due to its remarkable rusticity and edaphoclimatic plasticity (Mendonça et al. 2018). The cultivars used in the region are predominantly landraces, which, in contrast to commercial varieties, exhibit high levels of genetic variability (Silva et al. 2024). Considering that small farmers in the region use landrace seeds passed down through generations, which preserve valuable genetic characteristics, studying the morphological and agronomic aspects of traditional cowpea accessions is an essential step, since these varieties constitute a rich collection of genetic resources adapted to various agroecological niches.

Given the relevance of the crop and its great genetic potential, it is essential to conduct research aimed at identifying, describing, cataloging and selecting the most promising landrace varieties for breeding programs (Souza 2016). Despite the vast collection of cowpea genetic resources available, the scarcity of detailed data on the diversity of its germplasm hinders the advance of breeding programs (Gomes et al. 2021). Miqueloni et al. (2018), Gomes et al. (2020) and Lopes et al. (2023) point out that there is still little information in the literature about local varieties and their ecophysiological and morphophysiological differences, and that studies have been carried out for the selection of cowpea genotypes taking advantage of the variability of landrace cultivars.

Thus, the present study aimed to describe and classify landrace cowpea varieties with agronomic potential for the Rondônia state, in order to deepen the technological process for agricultural production in the northern region.

## MATERIAL AND METHODS

The experiment was conducted from April to July 2023, under field conditions, at the experimental area of the Instituto Federal de Rondônia, in Colorado do Oeste, Rondônia state, Brazil (13º06'S, 60º29'W and average altitude of 407 m). According to the Köppen-Geiger classification, the climate of the region is Aw (tropical climate with dry winter).

The average temperature and rainfall data during the experiment were obtained from the field climate database (Figure 1), and data from the soil chemical characterization (0-20 cm layer) in samples collected before the experiment showed the following results: pH ($H_2O$) = 6.9; OM = 28.2 g $kg^{-1}$; P = 32 mg $dm^{-3}$; K= 173 mg $dm^{-3}$; Ca = 15 $cmol_c$ $dm^{-3}$; Mg = 1.6 $cmol_c$ $dm^{-3}$; Al = 0.0 $cmol_c$ $dm^{-3}$; H + Al = 2.4 $cmol_c$ $dm^{-3}$; SB = 17.3 $cmol_c$ $dm^{-3}$; CEC = 19.8 $cmol_c$ $dm^{-3}$; and V = 87.5 %.

The design was randomized blocks, consisting of twenty-four traditional cowpea accessions and two replicates. The used cowpea accessions were: IFTO-PA 02, IFTO-PA 03, IFTO-PA 04, IFTO-PA 05, IFTO-PA 06, IFTO-PA 07, IFTO-PA 08, IFTO-PA 09, IFTO-PA 10, IFTO-PA 11, IFTO-PA 12, IFTO-PA 13, IFTO-PA 14, IFTO-PA 15, IFTO-PA 16, IFTO-PA 17, IFTO-PA 18, IFTO-PA 19, IFTO-PA 20, IFRO COL 1, IFRO COL 2, IFRO COL 3, FEIJÃO FEIRA and FEIJÃO PRAIA, and the seeds came from collections available at the municipalities of Pedro Afonso, Tupirama, Santa Maria do Tocantins and Bom Jesus do Tocantins (Tocantins state), Juazeiro (Bahia state) and Colorado do Oeste (Rondônia state), from 2012 to 2022, acquired directly from family farmers.

The crop was planted in a conventional tillage system, in which soil preparation consisted of one harrowing operation (disc harrow) up to 15 cm deep and the mechanical opening of planting furrows at the depth of 5 cm. Sowing was carried out manually, by placing four seeds per hole, leaving two plants per linear meter after thinning, representing a population of 40.000 plants $ha^{-1}$. Each experimental unit was composed of 3 rows of 5 m in length, at the spacing of 0.50 m between rows and 0.50 m between plants. The central row was used for evaluations, excluding 0.25 m from each end of the plot. Cultural practices were carried out according to recommendations for the cowpea crop.

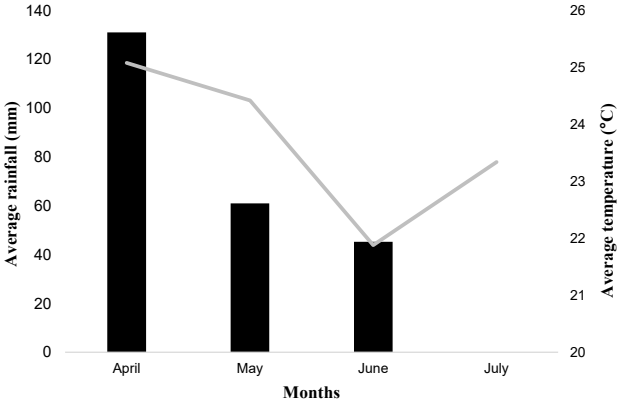


Figure 1. Average data of temperature and rainfall obtained during the field experiment (Colorado do Oeste, Rondônia state, Brazil).

The cowpea accessions were described according to the Biodiversity International (2007), considering the worldwide scope of the document, in relation to the descriptors established by Brasil (2010). A total of 14 morphoagronomic traits were described, of which six are qualitative and eight are quantitative, namely: growth habit, twining tendency, leaf color, flower color, pod curvature, plant vigor, number of days to emergence, number of days to flowering (recorded from the emergence of 50 % of the plants of each genotype until 50 % of the plants had at least one open flower); terminal leaflet length (mm), terminal leaflet width (mm), pod length (cm) (average of the 10 longest mature pods of 10 randomly selected plants), number of pods per plant (average number of mature pods of 10 randomly selected plants) and number of grains per pod (average obtained after counting the number of seeds of ten pods - randomly selected - of each genotype).

The results of the variables were obtained based on the descriptors for cowpea (Biodiversity International 2007), and the data were tabulated and analyzed using the Microsoft Excel® through descriptive statistics, considering a confidence level of 95 %.

## RESULTS AND DISCUSSION

Considering the results of the quantitative traits, and according to the values of the descriptive statistics (Table 1), there is a right-skewed distribution for the parameters number of days to emergence, terminal leaflet length and number of pods per plant, whereas the number of days to flowering, terminal leaflet width, pod length and number of grains per pod showed a negatively skewed distribution, i.e., left-skewed, positively correlating with the kurtosis coefficients in the range of -0.43 to +21.27, demonstrating the degree of flattening of the data distribution. In the standard deviation values, there is a greater dispersion of the data set in relation to the mean, with values greater than zero for all variables, and medians close to the mean (Table 1). These results are justified by the wide variation of the cowpea genetic materials studied under the local edaphoclimatic conditions.

The number of days until emergence among cowpea accessions presented an overall average of 4.58 days, with a standard deviation of 1.4, which suggests a moderate data variation (Tables 1 and 2). Accessions IFTO-PA 08 and IFTO-PA 10 presented the fastest emergence, at 3 days (Table 2). These results are in agreement with those obtained by Oliveira et al. (2015) and Souza (2016), who, when evaluating different cowpea genotypes, observed variations of 4.0 and 5.2 days for seedling emergence, respectively.

The number of days to flowering averaged 45.70 days across the different accessions. Most accessions flowered between 42 and 50 days, with the exception of accessions IFTO-PA 07 and IFTO-PA

Table 1. Descriptive statistics (95 % confidence level) of the quantitative descriptors number of days to emergence (NDE), number of days to flowering (NDF), terminal leaflet length (TLL), terminal leaflet width (TLW), pod length (PL), number of pods per plant (NPP) and number of grains per pod (NGP) of twenty-four traditional cowpea accessions grown under field conditions in Colorado do Oeste (Rondônia state, Brazil).

| Statistics | NDE | NDF | TLL | TLW | PL | NPP | NGP |
|---|---|---|---|---|---|---|---|
| Mean | 4.72 | 45.96 | 11.85 | 7.72 | 18.75 | 18.62 | 13.45 |
| Standard error | 0.23 | 0.63 | 0.34 | 0.14 | 0.43 | 2.19 | 0.48 |
| Median | 5.00 | 47.00 | 11.64 | 7.73 | 19.25 | 16.60 | 13.00 |
| Mode | 4.00 | 47.00 | 10.80 | 7.00 | 18.00 | 17.70 | 12.30 |
| Standard deviation | 1.14 | 3.14 | 1.71 | 0.69 | 2.17 | 10.96 | 2.41 |
| Variance | 1.29 | 9.87 | 2.93 | 0.48 | 4.69 | 120.16 | 5.82 |
| Kurtosis | 1.97 | -0.43 | 12.32 | -0.53 | 12.65 | 21.27 | 0.25 |
| Skewness | 1.16 | -0.41 | 3.00 | -0.15 | -2.97 | 4.44 | -0.53 |
| Interval | 5.00 | 12.00 | 9.10 | 2.60 | 12.10 | 59.10 | 9.90 |
| Minimum | 3.00 | 40.00 | 9.80 | 6.20 | 9.80 | 10.30 | 7.10 |
| Maximum | 8.00 | 52.00 | 18.90 | 8.80 | 21.90 | 69.40 | 17.00 |
| Sum | 118.00 | 1,149.00 | 296.16 | 192.95 | 468.85 | 465.60 | 336.30 |
| Count | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| Confidence level | 0.47 | 1.30 | 0.71 | 0.29 | 0.89 | 4.52 | 1.00 |

Table 2. Means (average values related to the behavior of the germplasm in the local cropping system) of the quantitative descriptors number of days to emergence (NDE), number of days to flowering (NDF), terminal leaflet length (TLL), terminal leaflet width (TLW), pod length (PL), number of pods per plant (NPP) and number of grains per pod (NGP) of twenty-four traditional cowpea accessions grown under field conditions in Colorado do Oeste (Rondônia state, Brazil).

| Accessions | Quantitative descriptors | | | | | | |
|---|---|---|---|---|---|---|---|
| | NDE | NDF | TLL | TWL | PL | NPP | NGP |
| IFTO-PA 02 | 4 | 49 | 11.5 | 7.2 | 19.3 | 18.3 | 16.8 |
| IFTO-PA 03 | 4 | 49 | 10.8 | 7.0 | 18.0 | 16.4 | 12.3 |
| IFTO-PA 04 | 4 | 42 | 11.8 | 7.2 | 19.1 | 19.7 | 15.6 |
| IFTO-PA 05 | 7 | 50 | 12.3 | 8.8 | 19.4 | 15.3 | 15.9 |
| IFTO-PA 06 | 5 | 46 | 11.9 | 7.8 | 17.8 | 17.3 | 16.2 |
| IFTO-PA 07 | 5 | 40 | 11.1 | 7.8 | 19.6 | 17.7 | 10.3 |
| IFTO-PA 08 | 3 | 46 | 11.0 | 8.1 | 18.0 | 21.2 | 12.5 |
| IFTO-PA 09 | 4 | 47 | 11.3 | 8.0 | 19.2 | 16.0 | 12.1 |
| IFTO-PA 10 | 3 | 45 | 11.6 | 7.1 | 17.8 | 21.1 | 13.0 |
| IFTO-PA 11 | 4 | 48 | 10.8 | 7.7 | 18.0 | 13.9 | 17.0 |
| IFTO-PA 12 | 4 | 44 | 11.4 | 8.5 | 17.3 | 16.8 | 12.2 |
| IFTO-PA 13 | 5 | 47 | 13.1 | 8.5 | 19.7 | 17.7 | 15.8 |
| IFTO-PA 14 | 5 | 46 | 12.1 | 7.8 | 19.3 | 20.8 | 15.7 |
| IFTO-PA 15 | 4 | 47 | 11.1 | 7.2 | 20.1 | 10.3 | 15.5 |
| IFTO-PA 16 | 5 | 40 | 18.9 | 6.7 | 19.3 | 10.7 | 11.9 |
| IFTO-PA 17 | 6 | 42 | 10.2 | 7.5 | 19.7 | 16.1 | 11.0 |
| IFTO-PA 18 | 4 | 42 | 12.6 | 7.7 | 18.8 | 16.5 | 12.6 |
| IFTO-PA 19 | 6 | 48 | 13.2 | 8.3 | 19.8 | 13.9 | 12.3 |
| IFTO-PA 20 | 5 | 42 | 12.3 | 8.5 | 19.1 | 16.0 | 14.3 |
| IFRO COL 1 | 5 | 46 | 12.4 | 8.8 | 21.9 | 18.9 | 153 |
| IFRO COL 2 | 5 | 48 | 11.7 | 8.8 | 21.6 | 11.5 | 15.1 |
| IFRO COL 3 | 5 | 49 | 9.8 | 7.0 | 19.3 | 17.4 | 13.2 |
| FEIJÃO FEIRA | 4 | 47 | 11.3 | 7.7 | 17.8 | 16.6 | 11.0 |
| FEIJÃO PRAIA | 4 | 47 | 12.2 | 7.4 | 19.6 | 16.1 | 11.6 |

16, which flowered earlier (40 days) (Table 2). Souza et al. (2019) obtained an overall average of 41.71 days for the initial flowering of nineteen cowpea genotypes cultivated under field conditions in the municipality of Mossoró; Araújo et al. (2021) found an average of 49.71 days for the initial flowering of twenty cowpea genotypes cultivated in the municipality of Teresina; and Santana et al. (2023) observed an average of 46.40 days for the initial flowering of different cowpea cultivars for green grain production.

Machado et al. (2008) suggest that the genetic gain in cowpea cycle earliness can negatively impact yield, an effect attributed to the shortening of the vegetative phase. This implies a probable reduction in photosynthate production, which is essential for biomass accumulation and grain yield. However, earliness, when considering rainfed or irrigated cropping systems, is a strategic agronomic characteristic, because it allows for the intensification of land use, enabling up to three harvests per year. According to Elteib et al. (2021), obtaining early-flowering materials is a promising strategy aimed at minimizing crop losses in the summer or stabilizing production in regions with prolonged dry periods, thus protecting the plant from biotic or abiotic stresses.

The length of the apical leaflet among cowpea accessions ranged from 9.8 to 18.9 cm, with an overall average of 11.92 cm and standard deviation of 1.71, suggesting significant variation among the twenty-four accessions. In contrast, the width of the apical leaflet varied between 6.7 and 8.8 cm, with an overall average of 7.78 cm and standard deviation of 0.69, suggesting less variation among the twenty-four cowpea accessions (Table 2). IFTO-PA 16 and IFRO COL 3 presented the longest and shortest leaflet lengths, respectively, whereas IFTO-PA 05, IFRO COL 1 and IFRO COL 2 had the greatest leaflet widths (8.8 cm). It should be noted that the length and width of the apical leaflet are intrinsically linked to the yield variable.

The accessions IFRO COL 1 and IFTO-PA 12 produced pods with the greatest and shortest lengths,

with 21.9 and 17.3 cm, respectively (Table 2). The overall average pod length among the traditional accessions was 19.12 cm, which is in line with the commercial standard (above 18 cm). Therefore, it can be stated that the accessions that exhibited superior averages have a great potential to be recommended for cultivation in the region or to be used in breeding programs that aim to select for this trait. In agreement with these findings, Souza et al. (2019) observed an overall average pod length of 19.93 cm among twenty-two cowpea genotypes evaluated under field conditions.

The average number of pods per plant among the twenty-four traditional cowpea accessions was 16.50, with a standard deviation of 10.96, indicating a large variation among the evaluated descriptors (Table 2). The average number of grains per pod was 13.71 grains, with a standard deviation of 2.41, indicating considerable variability (Table 2). The accessions IFTO-PA 15 and IFTO-PA 16 produced the lowest number of pods per plant, with 10.3 and 10.6, respectively, whereas IFTO-PA 10 and IFTO-PA 08 produced the highest number of pods per plant, with an average of 21.1 pods plant$^{-1}$. IFTO-PA 11 produced the highest number of grains per pod. Similarly, Marinho et al. (2021) found an average of 10.63 seeds pod$^{-1}$ among fourteen cowpea genotypes cultivated in the Amazonian ecosystem, and Praxedes et al. (2022) verified values between 9.9 and 15.1 seeds plant$^{-1}$ in fifteen traditional cowpea varieties in the Brazilian semi-arid region.

Regarding qualitative traits, Carvalho et al. (2017) point out that morphological descriptors are considered the most appropriate in determining a cultivar or variety, as they are mostly genetically controlled and independent of the environment and cultivation. The data were obtained through visual observations in representative plants of each plot, still under field conditions. The indeterminate growth habit corresponded to 79.16 % of the characterized accessions, whereas the determinate habit corresponded to 20.83 %, respectively (Table 3). All twenty-four traditional cowpea accessions were classified with intermediate vigor (Figure 2). Plant height ranged from 38.5 to 56.8 cm and widths between 36.3 and 64.5 cm, indicating an intermediate condition of vigor (height greater than 37 cm or width greater than 75 cm).

The accessions IFTO-PA 08, IFTO-PA 09, IFTO-PA 11, IFTO-PA 12, IFTO-PA 16, IFTO-PA 17, IFTO-PA 19 and FEIJÃO PRAIA showed no twining tendency. On the other hand, IFTO-PA 03, IFTO-PA 05, IFTO-PA 06, IFTO-PA 07, IFTO-PA 10 and IFTO-PA 13 showed a slight twining tendency, and IFTO-PA 02, IFTO-PA 04, IFTO-PA 14, IFTO-PA 15, IFTO-PA 18, IFTO-PA 20, IFRO COL 1, IFRO COL 2, IFRO COL 3 and FEIJÃO FEIRA had an intermediate twining tendency (Table 4).

Characteristics such as acute erect growth pattern and predominantly indeterminate growth habit, with no twining tendency, are conducive to the production system of the northern region, since, in these environments, production often occurs in floodplain areas, imposing challenges to the implementation of staking systems (Oliveira et al. 2015). On the other hand, the erect and semi-erect growth patterns and the determinate growth habit

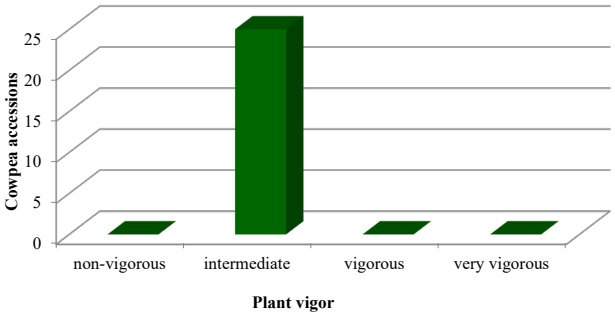


Figure 2. Qualitative classification regarding plant vigor of twenty-four traditional cowpea accessions grown under field conditions in Colorado do Oeste (Rondônia state, Brazil).

Table 3. Qualitative classification regarding the growth habit of twenty-four traditional cowpea accessions cultivated under field conditions in Colorado do Oeste (Rondônia state, Brazil).

| Growth habit | |
|---|---|
| Indeterminate | Determinate |
| IFTO-PA 02; IFTO-PA 03; IFTO-PA 04; IFTO-PA 05; IFTO-PA 06; IFTO-PA 07; IFTO-PA 09; IFTO-PA 10; IFTO-PA 11; IFTO-PA 14; IFTO-PA 15; IFTO-PA 18; IFTO-PA 19; IFTO-PA 20; IFRO COL 1; IFRO COL 2; IFRO COL 3; FEIJÃO FEIRA; FEIJÃO PRAIA | IFTO-PA 08; IFTO-PA 12; IFTO-PA 13; IFTO-PA 16; IFTO-PA 17 |

make cowpea ideal for harvesting and mechanical management, since these characteristics prevent excessive plant spreading and ensure a more compact and uniform architecture (Bezerra et al. 2001).

Regarding leaf color, light green was observed for the accessions IFTO-PA 08, IFTO-PA 09, IFTO-PA 11, IFTO-PA 12, IFTO-PA 16, IFTO-PA 17, IFTO-PA 19 and FEIJÃO PRAIA. IFTO-PA 02, IFTO-PA 05, IFTO-PA 06, IFTO-PA 07, IFTO-PA 10 and IFTO-PA 13 showed intermediate green leaf color, and IFTO-PA 03, IFTO-PA 04, IFTO-PA 14, IFTO-PA 15, IFTO-PA 18, IFTO-PA 20, IFRO COL 1, IFRO COL 2, IFRO COL 3 and FEIJÃO FEIRA showed dark green leaf color (Table 5).

For the flower pigmentation pattern, the accessions IFTO-PA 02, IFTO-PA 03, IFTO-PA 05, IFTO-PA 06, IFTO-PA 08, IFTO-PA 09, IFTO-PA 13, IFTO-PA 15, IFRO COL 2 and FEIJÃO FEIRA showed lavender color, whereas IFTO-PA 04, IFTO-PA 11, IFTO-PA 12, IFTO-PA 14, IFTO-PA 17, IFTO-PA 18 and IFTO-PA 20 showed lilac flower color. IFTO-PA 10, IFRO COL 1 and IFRO COL 3 showed pink flower color, and IFTO-PA 07, IFTO-PA 16 and FEIJÃO PRAIA showed white flower color. Violet leaf color was verified only for the accession IFTO-PA 19. Inflorescence characterization for the descriptor related to flower color showed variability of 41.66 % for violet, 29.16 % for lilac, 12.50 % for pink and white, and 4.16 % for violet (Table 6; Figure 3).

Regarding pod curvature, the accessions IFTO-PA 02, IFTO-PA 04, IFTO-PA 08 and IFRO COL 1 showed straight pods, whereas IFTO-PA 03, IFTO-PA 05 and FEIJÃO PRAIA showed slightly curved pods, and the other accessions showed completely curved pods (Table 7).

The northern region is an important center for the on-site conservation of cowpea in Brazil, and, according to the grouping, the twenty-four accessions were identified and had three classes of grains as established by the Brazilian Ministry of Agriculture, Livestock and Food Supply (Brasil 2008). In the Branco (white) class, the accessions IFPA-07,

Table 4. Qualitative classification regarding the twining tendency of twenty-four traditional cowpea accessions grown under field conditions in Colorado do Oeste (Rondônia state, Brazil).

| Twining tendency | | | |
|---|---|---|---|
| No twining | Slightly | Intermediate | Pronunced |
| IFTO-PA 08; IFTO-PA 09; IFTO-PA 11; IFTO-PA 12; IFTO-PA 16; IFTO-PA 17; IFTO-PA 19; FEIJÃO PRAIA | IFTO-PA 03; IFTO-PA 05; IFTO-PA 06; IFTO-PA 07; IFTO-PA 10; IFTO-PA 13 | IFTO-PA 02; IFTO-PA 04; IFTO-PA 14; IFTO-PA 15; IFTO-PA 18; IFTO-PA 20; IFRO COL 1; IFRO COL 2; IFRO COL 3; FEIJÃO FEIRA | - |

Table 5. Qualitative classification regarding leaf color of twenty-four traditional cowpea accessions grown under field conditions in Colorado do Oeste (Rondônia state, Brazil).

| Leaf color | | |
|---|---|---|
| Light green | Intermediate green | Dark green |
| IFTO-PA 08; IFTO-PA 09; IFTO-PA 11; IFTO-PA 12; IFTO-PA 16; IFTO-PA 17; IFTO-PA 19; FEIJÃO PRAIA | IFTO-PA 02; IFTO-PA 05; IFTO-PA 06; IFTO-PA 07; IFTO-PA 10; IFTO-PA 13 | IFTO-PA 03; IFTO-PA 04; IFTO-PA 14; IFTO-PA 15; IFTO-PA 18; IFTO-PA 20; IFRO COL 1; IFRO COL 2; IFRO COL 3; FEIJÃO FEIRA |

Table 6. Qualitative classification regarding flower color of twenty-four traditional cowpea accessions grown under field conditions in Colorado do Oeste (Rondônia state, Brazil).

| Flower color | | | | | |
|---|---|---|---|---|---|
| Lavender | Lilac | Pink | White | Violet | Yellow |
| IFTO-PA 02; IFTO-PA 03; IFTO-PA 05; IFTO-PA 06; IFTO-PA 08; IFTO-PA 09; IFTO-PA 13; IFTO-PA 15; IFRO COL 2; FEIJÃO FEIRA | IFTO-PA 04; IFTO-PA 11; IFTO-PA 12; IFTO-PA 14; IFTO-PA 17; IFTO-PA 18; IFTO-PA 20 | IFTO-PA 10; IFRO COL 1; IFRO COL 3 | IFTO-PA 07; IFTO-PA 16; FEIJÃO PRAIA | IFTO-PA 19 | IFTO-PA 01 |

IFPA-16 and FEIJÃO PRAIA were classified in the Fradinho subclass. The Preto (black) class, with a minimum of 90 % of grains with black integument, encompassed only the accession IFPA-14, whose subclass is Preto Fosco. In the Cores (colors) class, with a minimum of 90 % of grains of the Cores class, admitting up to 10 % of other cultivars of the Cores class with contrast in color or size, the accessions IFPA-03, IFPA-08, IFPA-11 and IFRO-COL3 were classified in the Mulato Liso subclass, and the accessions IFPA-09 and IFRO-COL1 were classified in the Mulato Rugoso subclass. The accessions IFPA-04, IFPA-12, IFPA-15, IFPA-17, IFPA-20 and IFRO-COL1 were classified in the Canapu subclass; IFPA-02, IFPA-06, IFPA-10, IFPA-13, IFPA-18, IFPA-19 and FEIJÃO FEIRA in the Corujinha subclass; and IFPA-05 in the Vinagre subclass.

The analysis of the cowpea accessions showed grain classification with predominance of 83.31 % of colored grains, 12.50 % of white grains and 4.16 % of black grains. This color distribution, together with the wide morphological diversity observed in other descriptors such as color of leaves, flowers, pods and production components, confirms that

Table 7. Qualitative classification regarding pod curvature of twenty-four traditional cowpea accessions cultivated under field conditions in Colorado do Oeste (Rondônia state, Brazil).

| Pod curvature | | | |
|---|---|---|---|
| Straight | Slightly curved | Curved | Curled |
| IFTO-PA 02; IFTO-PA 04; IFTO-PA 08; IFRO COL 1 | IFTO-PA 03; IFTO-PA 05; FEIJÃO PRAIA | IFTO-PA 06; IFTO-PA 07; IFTO-PA 09; IFTO-PA 10; IFTO-PA 11; IFTO-PA 12; IFTO-PA 13; IFTO-PA 14; IFTO-PA 15; IFTO-PA 16; IFTO-PA 17; IFTO-PA 18; IFTO-PA 19; IFTO-PA 20; IFRO COL 2; IFRO COL 3; FEIJÃO FEIRA | - |

Photos: Soraya Celino Martins

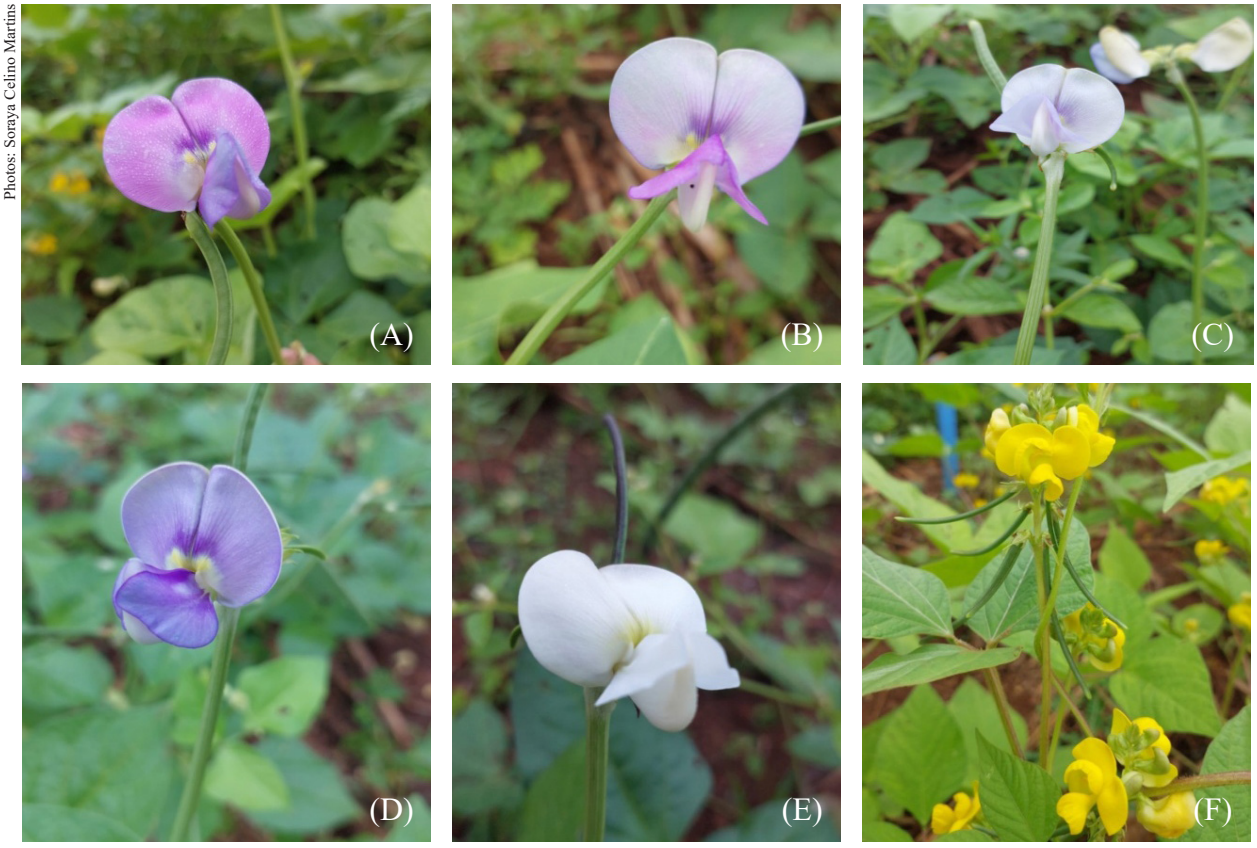


Figure 3. Cowpea flower color observed under experimental field conditions in Colorado do Oeste (Rondônia state, Brazil). A) pink; B) lavender; C) lilac; D) violet; E) white; F) yellow.

the northern region is an important center for on-farm conservation. The great genetic variability of the species is a reflection of its wide geographic distribution. Morphological characterization is, therefore, an essential step both for the management and conservation of germplasm banks, and for the identification of new varieties adapted to the various regions of Brazil.

## CONCLUSIONS

1. The high diversity of grain colors found in the cowpea accessions (83.31 % colored, 12.50 % white and 4.16 % black), combined with the wide morphological variability in other descriptors, confirms that the Brazilian northern region is an important center for on-farm conservation of the species;
2. The cowpea accessions with indeterminate growth habit (IFTO-PA 03, IFTO-PA 14 and IFTO-PA 15), as well as those with determinate growth habit (IFTO-PA 08, IFTO-PA 12, IFTO-PA 13, IFTO-PA 16 and IFTO-PA 17), with average flowering time of 45.12 days, showed equivalent and favorable agronomic performances under the local edaphoclimatic conditions, and are indicated for incorporation into family-based production systems and mechanized agriculture.

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