

**MICP 01-A NEW COWPEA [*VIGNA UNGUICULATA* (L.) WALP.] VARIETY
FOR CULTIVATION IN DRY AND INTERMEDIATE ZONES OF
SRI LANKA**

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ABSTRACT

Cowpea [*Vigna unguiculata* (L.) Walp.] is one of the important food legumes cultivated in Sri Lanka. One of the constraints to cowpea cultivation in Sri Lanka is the lack of high yielding varieties. There were only four varieties of cowpea recommended by the Department of Agriculture. Among these, variety MI 35 has the most attractive cream coloured seed coat but is low yielding compared to other varieties. Therefore, Field Crops Research and Development Institute (FCRDI) initiated a back cross breeding program to incorporate this seed coat colour in to the high yielding (>2 t/ha) breeding line MI85M2-4B4 which exhibited good yield stability over varying environments but with unattractive seeds. After five backcrosses, seed coat colour of MI 35 was transferred to the recurrent parent MI85M2-4B4 in order to develop the variety MICP 01. This variety performed well in the station yield trials, multi-locational yield trials, National Coordinated Variety Trial and Variety Adoptability Trial levels. In addition, this variety possesses better agronomic and seed quality characteristics than that of standards checks and it had a highly satisfactory farmers' response. Thus, MICP 01 was released for cultivation in Sri Lanka in 2011.

KEYWORDS: Cowpea, MICP 01, Backcross breeding, Recommended cowpea varieties .

INTRODUCTION

Cowpea [*Vigna unguiculata* (L.) Walp.] is an important food legume and an essential component of cropping systems in the dry region of Sri Lanka covering parts of the Dry and Intermediate zones of the country. Being a fast growing crop, cowpea control erosion by covering the ground, fixes atmospheric nitrogen and its decaying residues contribute to soil fertility. Nearly 11,900 ha of cowpea has cultivated in the year 2010 (Agstat, 2009). However, there were only four cowpea varieties recommended by the Department of Agriculture, namely, 'Bombay', 'MI 35', 'Waruni' and 'Dhawala' released in 1960, 1969, 1990 and 1997, respectively (Anonymous, 2000). Among these, all except MI 35 are introduced lines while the varieties Dhawala, Waruni and MI 35 are popular among the farmers, some farmers tend to cultivate varieties such as 'Arlington' due to higher preference for varieties with cream coloured seeds. Although variety MI 35

with small cream seeds matches the colour requirement, it is low yielding with an average yield of 0.8-1.5 t/ha. The maturity period of MI 35 varies between 60-80 days depending on the season.

'MI85M2-4B4', a cowpea line developed at Mahailuppallama by hybridization and selection using genetic material received from the International Institute of Tropical Agriculture (IITA) has given stable high yields over 2 t/ha while exhibiting vigorous plant structure and multi-coloured seed coat. However, consumer preference for multi-coloured seed coat is very low. This led to further improvement of 'MI85M2-4B4' with the incorporation of cream seed coat colour of MI 35 through a back cross breeding program (Singh, 1990) in order to develop a new cowpea variety 'MICP 01'. Therefore, the objective of this study paper is to present the performance of high yielding cream coloured cowpea variety MICP 01 which was released for cultivation in Sri Lanka in year 2011.

MATERIALS AND METHODS

The new variety MICP 01 was developed by the back cross breeding program initiated during *yala* season 1996 at the FCRDI, Mahailuppallama. Cowpea line MI85M2-4B4 was used as the high yielding recurrent parent and MI-35 was used as the cream coloured seed coat donor parent. Five back crosses were carried out to incorporate the cream coloured seed coat trait in to line MI85M2-4B4 line preserving all desirable traits of line MI85M2-4B4 (Figure 1). After preserving the desirable traits, BC₅F₁ generation was allowed for self pollination up to BC₅F₃ to obtain a pure line generation. Seven uniform and stable inbred lines possessing high yielding characteristics were identified for yield trials.

A preliminary yield trial was conducted in *maha* season 2001/02 and advanced yield trial was conducted in *yala* season 2002 with seven selected inbred lines and standard checks, namely, MI 35, Dhawala and Vijaya. Data were analysed using SAS computer software package and mean comparison was done by DMRT ($p=0.05$). Multi locational yield trials were conducted in two steps, National Coordinated Variety Trial (NCVT) and Variety Adaptability Trial (VAT). As the first step, NCVTs were conducted at four locations, FCRDI, Mahailuppallama, Grain Legumes and Oil Crops Research and Development Centre (GLORDC), Agunakolapalessa, Regional Agriculture Research and Development Centre (RARDC), Aralaganvila and School of Agriculture, Wariyapola in four consecutive seasons from *maha* 2002/03 to *yala* 2004. Upon good performance at the NCVT level, the new variety MICP 01 was included in VAT conducted under

farmers' conditions with the assistance of the extension officers of the DOA, in main cowpea growing areas including districts of Hambantota, Monaragala, Kurunagala and Anuradhapura in four consecutive seasons from *maha* 2006/07 to *maha* 2008/09 seasons in five location with 3-4 entries.

MI85M2-4B4 (Recurrent parent) x MI 35(Donor parent)

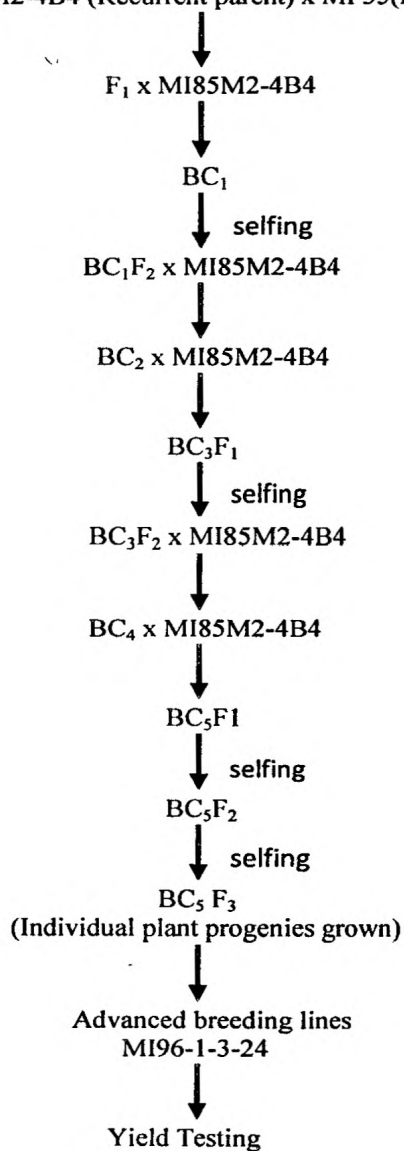


Figure 1. Back cross breeding procedure for the development of new cowpea variety MICP 01.

Multi locational yield data were analyzed by the method of Abeywardana *et al.* (1991) using the plot yield deviation from the environmental means. Selection of most adaptable varieties was performed based on the positive mean deviation (D) and no. of positive deviations across environments and the stability parameter. Quality of the new

cowpea variety MICP 01 was assessed in comparison to the standard check varieties MI 35, Dhawala and Waruni. Sensory evaluation was conducted with 22 panellists using 5 point hedonic scale for appearance, odour, taste, texture and overall acceptability. Furthermore, farmer response was also recorded during the VAT conducting seasons.

RESULTS AND DISCUSSION

Station yield trials

Seven lines were evaluated against 3 standard check varieties in *maha* 2001/02 and *yala* 2002 seasons at Mahailuppallama. In both seasons, MICP 01 performed well and showed higher yield than the recommended varieties (Table 1).

Table 1. Yield performance of cowpea breeding lines/varieties at Field Crops Research and Development Institute (FCRDI) in *maha* 2001/02 and *yala* 2002 seasons.

Breeding line/variety	Yield (t/ha)	
	<i>maha</i> 2001/02	<i>yala</i> 2002
MI 96-1-3-24(MICP 1)	2.40 ab	2.40 a
MI96 - 2-2-4	2.33 b	2.40 a
MI 96 – 8-3-4	2.20 bc	2.13 b
MI96 – 4-4-25(MICP 3)	1.76 d	2.00 b
MI 96 – 1-3-22	2.40 ab	2.36 a
MI 96- 11-3-12	2.06 c	1.76 c
MI 96- 2-2-26	2.56 a	2.13 b
MI 35	1.20 f	1.30 e
Dhawala	1.50 e	1.60 cd
Wijaya	1.50 e	1.47 de
CV (%)	5.40	5.37

Note: Within each column, the means followed by the same letter are not significantly different at $p = 0.05$.

National Co-ordinated Varietal Trial (NCVT)

Data were analyzed by the method proposed by Abey Siriwardena *et al.* (1991). High yielding varieties were selected based on the positive mean deviation (D) across environments. In all four seasons, the proposed variety MICP 01 and two check varieties Dhawala and Waruni were found to be highly adaptable across environments, but MI 35 was found to be less adaptable than the proposed variety MICP 1 (Tables 2, and 3). However, the stability parameter was significant.

Table 2. Mean yield, Mean plot deviation and Stability parameter (S^2) of the entries tested in national coordinated variety trial (NCVT) conducted in *maha* 2002/03, *yala* 2003 and *maha* 2003/04 seasons.

Line/entry	Maha 2002/03			Yala 2003			Maha 2003/04		
	Mean yield (t/ha)	Plot Deviation (D) t/ha	Stability parameter (S^2)	Mean yield (t/ha)	Plot Deviation (D) t/ha	Stability parameter (S^2)	Mean yield (t/ha)	Plot Deviation (D) t/ha	Stability parameter (S^2)
MICP 1	1.51 a	0.26 a	0.31 *	1.93 a	0.19 a	0.284*	1.89 a	0.26 a	0.67 *
MICP 2	0.89 b	-0.35 b	0.17	1.56 b	-0.17 b	0.395*	1.61 abc	-0.0056 abc	0.64*
MICP 3	1.06 b	-0.18 b	0.28 *	1.81 ab	0.078 ab	0.222	1.62 abc	0.003 abc	0.24
MI 35	1.10 b	-0.14 b	0.01	1.71 ab	-0.025 ab	0.073	1.33 c	-0.28 c	0.24
Dhawala	1.52 a	0.27 a	0.15	1.65 ab	-0.086 ab	0.009	1.56 bc	-0.06 bc	0.57 *
Waruni	1.40 a	0.26 a	0.08	1.79 ab	0.056 ab	0.811*	1.72 ab	0.101 ab	0.82*

Note: Within each column, the means followed by the same letter are not significantly different at $p = 0.05$. *Significant at $p=0.05$

Table 3. Mean yield, mean plot deviation and stability parameter (S^2) of the entries tested in national coordinated variety trial (NCVT) in *yala* season 2004.

Line	Mean yield (t/ha)	Plot Deviation (D)	Stability parameter (S^2)
MICP 1	2.38 a	0.54 a	0.27
MICP 2	1.57 b	-0.26 b	0.0098
MICP 3	1.71 b	-0.12 b	0.21
MI 35	1.56 b	-0.26 b	0.16
Dhawala	2.02 ab	0.19 ab	0.099
Waruni	1.79 b	-0.042 b	0.020

Note: Note: Within each column, the means followed by the same letter are not significantly different at $p = 0.05$. *Significant at $p=0.05$.

Table 4. Mean yield (t/ha), mean plot deviation (D) and stability parameter (S^2) of the tested entries in VAT maha 2006/07, yala 2007 and yala 2008 seasons.

Line	Maha 2006/07			Yala 2007			Yala 2008		
	Mean yield (t/ha)	Plot Deviation (D)	Stability parameter (S^2)	Mean yield (t/ha)	Plot Deviation (D)	Stability parameter (S^2)	Mean yield (t/ha)	Plot Deviation (D)	Stability parameter (S^2)
MICP 1	1.59 a	0.17 a	0.049	1.20 ab	0.043 ab	0.072 ns	1.27 a	0.33 a	0.048 ns
MICP 2	1.37 bc	-0.04 bc	0.103	1.05 b	-0.10 b	0.014 ns	0.92 b	-0.017 b	0.003 ns
MICP 3	1.52 ab	0.10 ab	0.021	-	-	-	0.90 b	-0.034 b	0.085
MI 35	1.21 c	-0.20 c	0.29 *	0.75 b	-0.40 b	0.126 ns	0.68 c	-0.262 c	0.12
Dhawala	-	-	-	1.63 a	0.47 a	0.49 ns	-	-	-
CV%	4.09			4.1			10.6		

Note: Note: Within each column, the means followed by the same letter are not significantly different at $p = 0.05$. *Significant at $p=0.05$.

Table 5. Mean yield (t/ha), mean plot deviation (D) and stability parameter (S^2) of the tested entries in variety adaptability trial (VAT) in maha 2008/09 season.

Line	Mean yield (t/ha)	Plot Deviation (D)	Stability parameter (S^2)
MICP 1	1.57 a	0.20 a	0.038 ns
MICP 3	1.14 b	-0.22 c	0.175
MI 35	1.38 b	0.02 b	0.058
CV (%)	8.01		

Note: Note: Within each column, the means followed by the same letter are not significantly different at $p = 0.05$. *Significant at $p=0.05$.

Table 6. Mean sensory scores of the tested cowpea varieties after boiling.

	<i>Appearance</i>	<i>Odour</i>	<i>Taste</i>	<i>Texture</i>	<i>Overall acceptability</i>
Dhawala	2.32	1.77	1.59	1.27	1.73 ^a
MI 35	2.18	2.22	2.54	2.91	2.73 ^b
MICP 01	1.5	1.59	1.63	1.82	1.59 ^a

Note: The means with the same letter are not significantly different at $p = 0.05$. Sensory scale: 1=Like very much, 2=Like, 3=Neither like nor dislike, 4=Dislike, 5=Dislike very much.

Table 7. Water requirement and times for soaking and boiling of tested cowpea varieties

	<i>Water requirement for soaking (%)</i>	<i>Soaking time (minutes)</i>	<i>Water requirement for boiling (%)</i>	<i>Boiling time (minutes)</i>
Dhawala	153.8	145	257.5	60
MI 35	183.8	75	192.5	35
MICP 01	190.0	100	227.5	42

Table 8. Crude protein content of tested cowpea varieties.

<i>Variety</i>	<i>Crude protein content (%)</i>
Dhawala	19.32 ± 0.25
Waruni	21.57 ± 0.00
MI 35	19.53 ± 0.40
MICP 01	21.07 ± 1.22
MICP 03	19.53 ± 0.40

Variety Adaptability Trial (VAT)

Highly adaptable varieties were selected based on the positive mean deviation (D) across environments and stability parameter (S^2). The MICP 01 has given the highest positive mean deviation and non-significant S^2 in all seasons when compared to the standard check MI 35 (Tables 4 and 5). Even in *yala* season 2007 MICP 01 was comparable to Dhawala

Quality assessment

No significant differences were observed in appearance or odour of the samples. Though the acceptability of MICP 01 was lower than that of other two varieties, its sensory attributes were acceptable (mean sensory scores was below 3). Mean scores for sensory attributes are given in Table 6. Variety MICP 01 requires comparatively less for soaking and boiling. Water requirement and times for soaking and boiling of Cowpea varieties are given in Table 7. The crude protein content of recommended cowpea

varieties are given in Table 8. Variety MICP 01 and Waruni show higher protein content compared to other varieties. When considering the response to biotic stresses both MICP 01 and MI 35 varieties were susceptible to major pest and diseases such as collar rot, pod borer and bruchids. In addition, majority (70 %) of the farmers who were involved in the VAT, preferred MICP 01 over MI 35 because of its superior plant structure which can compete with weeds to a certain extent, determinate growth pattern and seed characteristics (seed size and the attractive seed coat colour). Variety MICP 01 seeds are rhomboid shape with smooth texture and uniformly coloured seed coat. MICP 01 has 120 g of 1,000 seed weight while MI 35 has only 80 g of 1,000 seed weight. Furthermore, 75 % of the harvest from the new variety could be obtained from the first pick. Further, this variety could be used as a substitute for lentils after splitting and also as an alternative for breakfast after boiling.

CONCLUSIONS

The attractive seed coat colour of MI 35 has been successfully transferred to high yielding MI85M24B4 through a back cross program. The new variety, MICP 01 with high yield potential, vigorous plant structure and attractive seed coat colour was developed. Besides, MICP 01 is able to compete with weeds due to the well-developed canopy structure and a determinate type growth pattern where 70 % of the harvest can be obtained from the first pick.

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