

**STUDY ON SEED SETTING PERFORMANCE OF SELECTED CLUSTER ONION
(*Allium cepa* L.) CULTIVARS UNDER VERNALIZATION AND NON-
VERNALIZATION CONDITIONS**

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*Department of Agricultural Biology, Faculty of Agriculture, University of Jaffna, Sri Lanka***Abstract**

Cluster onion is popular among the growers of northern province and preferred by consumers throughout the state for its size, storability and palatability. This research presents an overview of the study of floral biology associated with cluster onion germplasms to improve cluster onion seed setting for hybridization. This was conducted at Regional Agricultural Research and Development Centre, Killinochchi using a Factorial Randomized Complete Block Design with three replicates. One standard variety (MICLO 1) with four selected cultivars (TVM 1, TVM 6, MH 4 & *Kundu vallarai*) of red onion were used. Five cultivars of onion with different methods taken as treatments *viz*, vernalization and non – vernalization. The research period from March 2022 to May 2022 to evaluate the floral behavior and hybridization of different onion germplasms under rainfed and irrigation conditions in Dry zone. Observations were analyzed in ANOVA using SAS software. This study shows that the vernalization process had a substantial impact on floral behavior and was helpful for the developing hybridization program. Significant differences were found between the vernalization and non-vernalization conditions. Overall, the study found that vernalization improves flowering ability, flower presence in umbels, umbel size, and seed quantity and quality. The most flowering onions were MH4 and MICLO 1 showed the highest number of flower count, umbel diameter, flower stalk and flower stalk width. TVM 6 and TVM 1 showed the intermediate responses with two treatments. But during the research period TVM 1 was most affected by fungal attack and the TVM 6 was field tolerant to major fungal disease and *Kundu vallarai* had the lowest responses with these two treatments because of this non-flowering ability.

Keywords: Cluster onion, cultivar, floral biology, germplasm, vernalization**Introduction**

Onion production is important in the Sri Lankan economy, helping to ensure rural empowerment opportunities. In Sri Lanka, Jaffna district is primarily an agricultural area with enormous potential for commercial agriculture production. In Valikamam-East and Vadamarachchi area in Jaffna, red onions are cultivated and farmers use seed onion for their cultivation (Thayaparan and Kajendeni, 2020). Onion is thought to have been carried to Sri Lanka by ancient traders from Tamil Nadu, particularly to northern areas, and then spread to other parts of the country.

Floral biology study is highly concerned with flower function in order to promote pollination and hybridization. Floral biology of a cluster onion is an essential for developing an effective program of genetic improvement through hybridization. It is the most important member of the family Alliaceae with monocotyledonous and cross-pollinated behavior (Sathiyamurthy and Harish, 2017). Onion production sometimes fall down due to scarcity of seeds. Huge differences are observed on the average seed yield as it depends on genotype, locality and method of seed production. Therefore, the objective of the study was to investigate floral behavior of different cultivars/ variety with vernalization and non- vernalization conditions to select good parents to improve the hybridization in cluster onions.

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Materials and Methods

An experiment was carried out among five germplasms planted with two different treatments T₁:(Vernalization) and T₂ (Non-vernalization). Experimental design was Factorial Randomized Complete Block Design with three replicates. MH 4, MICLO 1, TVM 6, TVM 1 and *Kundu vallarai* bulbs were planted in each plot. Bulbs were planted in raised beds, Maha season (march 2022 to May 2022) at Regional Agricultural Research and Development Centre, Killinochchi, Sri Lanka. The area fall under Low country Dry Zone (DL3) agro-ecological region. All cultural practices were followed as recommended by the Department of Agriculture, Sri Lanka. The study of floral biology and selection for the best parental line for the hybridization program observed from: Number of days for bud formation, Number days for first flowering, Number of days for fifty percent flowering, Anthesis time, Anther colour, Stigma colour, Anther dehiscence, Number of umbels per plot, Umbel diameter. Flowers per umbel, Flower stalk height, Flower stalk width, Seed set percentage through self and cross pollination, total seeds per plot were analyzed using analysis of variance (ANOVA) with SAS-9.1 package.

Results and Discussion

Number of days taken to first and fifty percent flowering

It was observed that flowering of cluster onion was significantly ($p < 0.05$) influenced by the treatments. MH4 and MICLO1 showed earliest flowering without significant differences between them. *Kundu vallarai* obviously showed the non-flowering in both treatments. The highest days were recorded in TVM 1 and TVM 6.

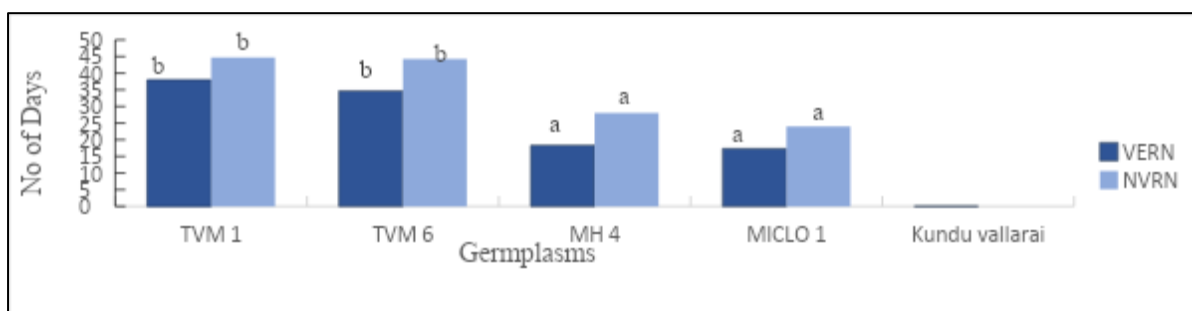


Figure 1: Mean number of days for first flowering of five onion germplasm under different treatments

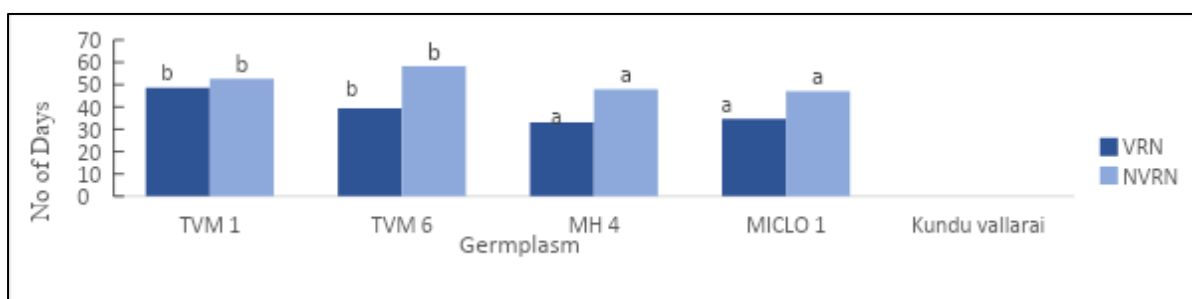


Figure 2: Mean number of days for fifty percent flowering of selected cultivars under different treatments

This study might reflect the effect of vernalization and non-vernalization on flowering of cluster onion. Within treatment, Vernalization treatment was most effective which stimulated early flowering of onion bulbs.

Anthesis and Anther dehiscence

In Onion anthesis occurred between 11.00 a.m. to 1.00 p.m. The peak level of flower opening was seen during this time period. After anthesis, the anther dehiscence was observed in the evening. The next day of anthesis, however, the peak level of anther dehiscence was seen between morning 9.30am and evening 5pm.

Anther colour

Table 1: Anther color in different stages (RHS value)

Color Group	Number
Yellow green group	N144- B
Yellow green group	N144-A
Yellow green	147-C
Greyed -orange group	164-B

Number of umbels per plot

There were significant differences ($p < 0.05$) among treatments. There was no any significance difference between MH 4 and MICLO1 germplasms. However, these two germplasms differ greatly from the other three. When compared to TVM 1, TVM 6, and *Kundu vallarai*, MH 4 and MICLO 1 exhibited greater flowering ability. In vernalized condition umbels mean value this was the higher number value than non-vernalization condition.

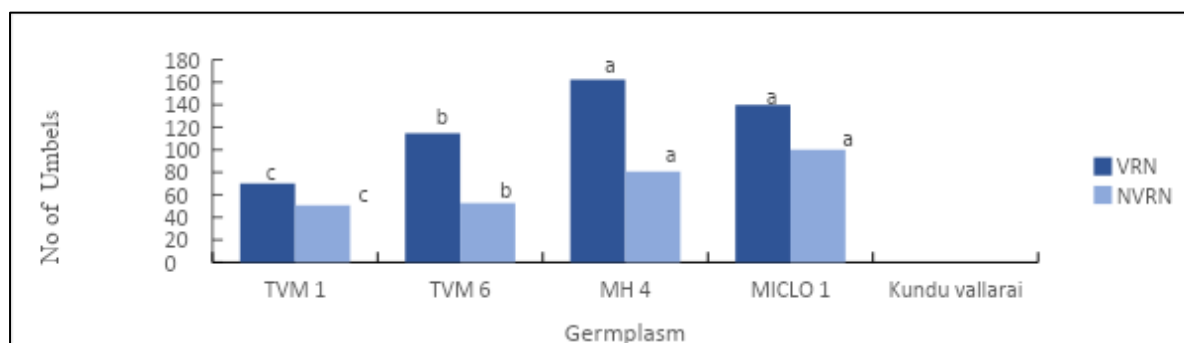


Figure 3: Mean Number of Umbels of selected onion germplasms under different treatments.

Umbel width of selected cultivars

Umbel diameter is an important growth parameter that has a direct impact on seed yield. When the umbel diameter increases, it may hold more seeds, resulting in an increase in seed yield. There was an interaction between the vernalization and non-vernalization conditions, as well as distinct five germplasm and umbel diameters. Among the treatments with germplasms MH4 and MICLO1 had highest umbel width than other treatment. When compared to non-vernalized bulbs, vernalized bulbs have a higher number of flowers in the umbel and wide umbel. Therefore, there was a significance effect on umbel width by vernalization.

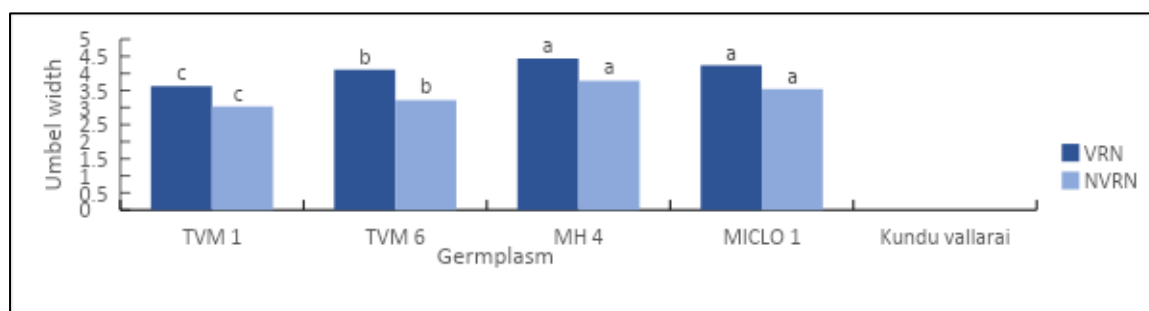


Figure 4: Mean value of umbel width of onion cultivars under different treatments.

Table 1: Means values of growth parameters and floral parameters with different treatments

Parameter	Vernalization					Non- vernalization				
	V1	V2	V3	V4	V5	V1	V2	V3	V4	V5
Establishment%	99.00 ±1.73 ^a	99.33 ±0.58 ^a	100 ^a	97.67 ±2.52 ^a	99.33 ±1.15 ^a	92.33 ±0.58 ^a	96.67 ±2.08 ^a	95 ±2.65 ^a	93.67 ±3.21 ^a	92 ±4.36 ^a
Bud formation (Days)	21.67 ±0.58 ^b	13.00 ^c	7.33 ±0.58 ^d	7.00± 1.00 ^d	0	28.33 ±2.52 ^b	15.33 ±1.53 ^c	9.67 ±0.58 ^d	10.00 ±1.00 ^d	0
1 st Flowering (Days)	38 ±1.00 ^b	34.67 ±3.79 ^b	18.33 ±4.51 ^c	17.33 ±3.21 ^c	0	44.67 ±5.51 ^b	44.33 ±1.51 ^b	28.00 ±2.65 ^c	24.00 ±1 ^c	0
Umbels per plot	70 ±11.36 ^c	114.67 ±22.37 ^b	162.33 ±26.54 ^a	140 ±3.61 ^a	0	50.67 ±1.53 ^c	52.67 ±3.21 ^b	60.67 ±1.53 ^a	100 ^a	0
No.of flowers per umbel	87.43 ±2.88 ^c	82.60 ±10.04 ^c	117.53 ±2.27 ^b	126.53 ±3.00 ^a	0	55.2 ±2.88 ^c	66.4 ±2.98 ^c	99.5 ±1.99 ^b	110.17 ±7.78 ^a	0
Flowerstalk per plant	4.13 ±0.23 ^a	2.63 ±0.06 ^b	3.83 ±0.40 ^a	3.6 ±0.2 ^a	0	3.27 ±0.50 ^a	2.1 ±0.1 ^b	3.37 ±0.05 ^a	3.6 ±0.1 ^a	0
Umbel width (cm)	3.63 ±0.09 ^c	4.11 ±0.14 ^b	4.44 ±0.42 ^a	4.24 ±0.43 ^a	0	3.02 ±0.04 ^c	3.22 ±0.07 ^b	3.79 ±0.18 ^a	4.22 ±0.09 ^a	0
Flowerstalk height	31.5 ±1.54 ^{ab}	36.42 ±2.91 ^a	35.54 ±4.79 ^a	35.94 ±2.62 ^a	0	36.59 ±1.13 ^{ab}	36.93 ±4.54 ^a	37.63 ±2.29 ^a	36.33 ±5.92 ^a	0
Flowerstalk width	9.35 ±0.34 ^b	7.47 ±0.12 ^c	8.07 ±0.72 ^b	9.58 ±0.47 ^a	0	5.08 ±0.09 ^b	4.46 ±0.05 ^c	6.15 ±1.00 ^b	7.70 ±0.72 ^a	0

Conclusion

Based on the results, vernalization is one of the most effective treatments for increasing seed setting on onion crops. According to the results showed that MH4, MICLO 1, and TVM 6 are the best for the hybridization process. Using these three varieties/cultivars can increase the success of hybrid seed production.

Acknowledgement

I would like to thank those who are providing support during this study to make my research worthwhile.

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