

EFFECTS OF BULB VERNALIZATION ON SEED PRODUCTION
OF ONION (*Allium cepa* L.) AT JUJA, KENYA

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ケニアでのタマネギの種子生産に及ぼす春化处理の影響

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Summary

Artificial vernalization of onion bulbs (cv. Red Creole) resulted in flower and seed production at Juja (1500m), Kenya where natural flowering was not possible due to lack of chilling temperatures.

Of the two temperature ranges tested, 2°C and 8°C plus control, 8°C induced flowering and seed production while no flowering was observed with 2°C treatment and control.

Eight weeks vernalization duration produced higher seed yield than 6, 4 and 2 weeks. The higher seed yield were due to earlier flowering, higher number of flower stalks and higher percent flowering.

摘 要

ケニアのジュジャ（海拔 1500m）では花芽分化に必要な低温量に不足するため、自然条件下でタマネギは開花しない。しかし、タマネギの‘レッドクレオール’を用いて鱗茎に春化处理を行うことにより、開花と結実を誘導した。

春化处理温度として2°C区と8°C区を設けた。2°C区と対照区では開花は起こらなかったが、8°C区では開花と結実が誘導された。

2, 4, 6週間の処理に比べ、8週間処理区では種子生産量は増加した。早期に開花するほど、花茎数の多いほどまた開花率の高いほど、種子生産量は増加した。

Introduction

Onion is an important vegetable in Kenya. However, seeds used for propagating this crop cannot be produced locally since Kenya lies on the tropics and therefore lacks the chilling temperatures required for flower induction. The country therefore has to rely heavily on importation of onion seeds. Attempts to grow onion seeds in the high altitudes of Kenya (above 2500m) has posed some problems due to high rainfall and low temperatures throughout the the year in these regions⁽⁶⁾.

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Early researchers showed that vernalization of onion bulb at 7°C to 12°C resulted in flowering and consequently seed production^(1,2,4). However these workers carried out their investigations in a greenhouse under controlled temperatures.

This work was undertaken to investigate whether vernalized onion bulbs could flower under field and tropical conditions at Juja (1500m) Kenya. The effects of different vernalization temperatures and durations on flowering and seed production were also compared.

Materials and Methods

Certified seeds of onion cv. 'Red Creole' was used in this experiment. These seeds were bought from a seed company in Kenya which had imported the seeds from Europe. This cultivar was chosen because it is open pollinated and very popularly consumed due to its red colour and pungency. The experiments were run for two consecutive seasons in 1985 to early 86.

Onion bulbs were raised following the recommended procedure for market bulb production. After harvesting, medium sized bulbs of about 4 cm. in diameter were selected for the experiment. These were allowed to dry for some time.

In the first experiment, the effects of two vernalization temperatures, 2°C, 8°C plus control was studied. One hundred bulbs for each treatments were put in a net bag and placed in 2°C and 8°C cold rooms, respectively for eight weeks. The controls were not vernalized.

After establishing the best vernalization temperature, the second experiment was carried out to test the best vernalization duration by using 2, 4, 6 and 8 weeks and the control. The same number of bulbs were used as in the first experiment.

In the first experiment, the vernalized bulbs and the control were planted in a complete randomized design with 4 replicates, while in the second experiment, complete randomized block design was used with 4 replicates.

The spacing used was 60 cms between rows and 30 cms between bulbs. Double super phosphate (46% P₂O₅) was applied during planting at the rate of 10 grams per hole. Bulbs were planted uprightly and completely covered with soil, leaving a small portion of the tip. The seed crop was top-dressed with calcium ammonium nitrate (26% N) at the rate of 10 grams per plant just before flowering.

Results

Experiment I.

The bulbs vernalized at 2°C and control did not flower at all. The 8°C treatment induced flowering at Juja (1500m). The first flower appeared 6 weeks after planting the bulbs and reached 50% flowering after 9 weeks. The average seedstalk height was 69 cms and the average seedstalk number per plant was 3. Table 1 shows the seed yield obtained.

Table 1. Showing seed yield data for bulbs vernalized at 2°C and 8°C

Treatment	Treatment mean ¹ in (g)
2°C	0
8°C	60.1
Control	0

¹Average of 4 replicates each m²

Experiment II

The 8°C was used as the vernalization temperature using the results from experiment 1. All vernalization durations induced flowering. However as shown in Fig.1 the 8 weeks vernalization

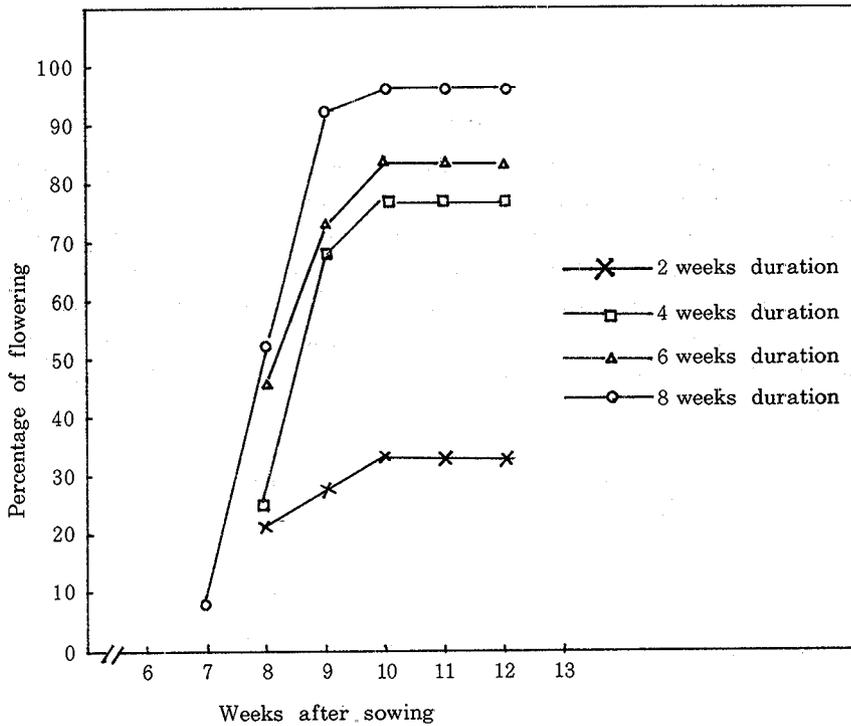


Fig. 1. Effects of different durations of cold treatment on flowering of onion (cv. 'Red Creole').

duration was the first to flower at 7th week after planting. All the other treatments started flowering on the 8th week. The control did not flower.

The average number of flower stalks per plant for 8, 6, 4 and 2 weeks vernalization durations was 3, 2, 2 and 1, respectively. The average seedstalk height for all the treatments was 65 cms.

Table 2. Duncan's multiple range test for seed yield in different vernalization durations at 5%

Treatment	Treatment mean ¹ in (g)	Statistical significance
8 weeks duration	61.5	a
6 weeks duration	37.0	b
4 weeks duration	35.25	b
2 weeks duration	7.0	bc
Control	0	bcd

¹Average of 4 replicates each m²

The 8 weeks vernalization duration gave the highest seed yield (Table 2). There was no significant difference in seed yield between 6 weeks and 4 weeks vernalization duration. Two weeks gave significantly the lowest seed yield.

The harvested seeds had a germination of 90% at room temperature and the weight of 1000 seeds was 3 grams.

Discussion

Only two vernalization temperatures were compared (2°C and 8°C) in this work due to the availability of the cold rooms. However, the results showed that very low vernalization temperatures might not be suitable for onion seed production at Juja since those bulbs vernalized at 2°C did not flower. This agrees with early workers who found that onion bulbs which were stored at temperatures of 7.2°C to 12.8°C produced more seeds than those stored at 0°C to 2.2°C^(3,4). Also extremely low or high temperatures have been found to inhibit or delay formation of flower primordia in onion^(5,6). The control did not flower showing temperatures at Juja could not provide natural chilling Table 3 and 4.

Table 3. Temperature data in 1985 during the time the first experiment was in the field.

Month	Max. temp., °C	Max. temp., °C
March	25.5	15.7
April	24.5	15.7
May	23.5	14.9
June	24.1	11.9
July	22.1	13.0

Table 4. Temperature data in 1985-86 during the time the second experiment was in the field.

Month	Max. temp., °C	Min. temp., °C
September	25	12
October	28	13
November	25	17
December	26	14
January	28	13

Bulbs vernalized for 8 weeks duration gave significantly higher seed yield than those vernalized at 6, 4 and 2 weeks (Table 2). The higher yield in 8 weeks vernalization duration was due to earlier flowering, more flower stalks per plant and higher percentage flowering than in other

duration treatments. These characteristics have been found to be some of the seed yield components in onion⁽²⁾.

This work shows that with more research, the low altitudes of Kenya such as Juja could be in future used for onion seed production by artificial vernalization of the bulbs.

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