

close-set fleshy flowers are unisexual, the pistillate ones being basal, and the staminate ones terminal, separated by a band of sterile, malformed flowers. The first day of flowering, the spathe is fully open, and the receptive pistils are sticky. The second day the spathe is closed, and the third day the spathe reopens, but only above the median constriction. During this second opening, the anthers shed pollen, but the pistils are sealed off from self pollination. A spicy fragrance accompanies the flowering. A camel's hair brush serves best to transfer ripe pollen to receptive stigmas. Formerly, it was the practice to remove the spathe with a sharp knife, but the author has observed a great many failures due to water getting on the pollinated stigmas, and subsequent fungus attack. Now it is recommended to open the spathe wider than normal by hand and insert the brush without danger to the inflorescence. Early morning is apparently the

best time for pollination. Pollen has been stored for 24 hours, no longer time has been tried. Successfully pollinated inflorescences remain erect, failures bend over within a few days. Ripening of seed takes four to six months, and ends with the protecting spathe disintegrating to show the full, juicy, orange berries. Seed should be carefully squeezed out, cleaned, and planted immediately in shredded sphagnum. Germination takes one to eight weeks.

Descriptions of kinds so far not introduced in Florida may be found in Bailey's *Standard Cyclopedia of Horticulture* 1: 254-255 Macmillan, N. Y. 1947, or Chittenden's *Dictionary of Gardening* 1: 82-83 University Press, Oxford, 1951. Bailey's is to be preferred over the less accurate Chittenden's.

The photographs accompanying this article were taken by Mr. Nixon Smiley of the *Miami Herald*.

GROWING TULIPS IN NORTHERN FLORIDA

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For many years it has been thought that tulips are not suited for growing in Florida. This was generally true, because bulbs grew poorly, many failed to flower, deteriorated and were lost, making it necessary to replace them each year.

Work has been done at Gainesville, starting in 1946-47, to determine the proper time and temperature for cold storage treatment of tulip bulbs to be planted in Florida. Varieties used during this work were the Darwin varieties, The Bishop, Scarlet Leader and Clara Butt, and Inglescombe Yellow of the Cottage group. European grown "first size" bulbs, obtained from commercial sources, were used in the experiments. Cold storage was started as soon as the bulbs were received, which was in late September or early October each year. The times of all storage treatments were those given the bulbs after their arrival in Gainesville.

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EXPERIMENTAL RESULTS

The results of several experiments have shown that tulip bulbs given the proper cold storage treatment will grow well and will produce very good flowers in the North Florida areas when planted outdoors. It should be stressed, however, that these bulbs will flower satisfactorily only once, and must be replaced with new bulbs each year. Several factors affect the results obtained by the home gardener and commercial seedsman. Some of these will be discussed below.

Probably the two most important factors that influence growth and flowering of tulip bulbs planted in Florida are duration of the cold storage period and the temperature at which the bulbs are stored. Other factors of considerable importance are storage conditions previous to the start of cold storage treatments, the time that elapses after removal from cold storage before planting, and the temperature at which they are kept until planted.

Bulbs given the same cold storage treatment and planted outside may vary somewhat from year to year in time required from planting until flowering, because of seasonal variations in temperature and other factors affecting growth.

Storage treatments that produced both good and poor flowering and time required for the bulbs to flower can be illustrated by data from the 1951-52 experiment, presented in Table 1.

Bulbs stored at 50° F. for 60, 90 and 120 days flowered as well as those stored at 40° F. for the same times (Table 1). However, for the same time periods—60, 90 and 120 days—bulbs stored at 40° F. required less time to flower than those stored at 50° F. Bulbs given 30 days of room temperature storage followed by 60 days at 40° F. flowered as well as other good treatments. When the room temperature period was extended to 60 days followed by 60 days at 40° F., flowering was reduced. When bulbs were stored for 60 days at 40° F. plus 30 days at room temperature, they flowered very poorly. Thirty days warm storage following cold storage cancelled most of the effects of cold storage. Ninety days storage at 36° F. considerably reduced flowering.

The four varieties grown usually flowered well under good storage treatments; however, when adverse storage conditions were introduced into the experiments, some of the varieties did not flower as well as others. Scarlet Leader, for example, was not nearly as good as The Bishop (Table 1).

Bulbs of the varieties The Bishop, Scarlet Leader and Clara Butt, planted seven days after removal from 60 days cold storage at 40° F., flowered as well as those planted the

day of removal; flowering was reduced by 14, 21 and 28 days of room temperature storage following the cold storage. The flowering of bulbs cold-stored 90 days at 40° F. was seriously reduced by the 7, 14, 21 and 28 days of room temperature storage as compared with those planted when removed from cold storage (Table 2).

TESTS AT BRADENTON AND ORLANDO

Bulbs of the varieties Scarlet Leader, The Bishop and Clara Butt, cold stored at 40° F. for 66 days, shipped to Bradenton and planted there four days after removal from cold storage, December 13, flowered satisfactorily. They required an average of about 60 days to flower. Similar results were obtained from bulbs of these varieties cold stored at 40° F. for 66 days but planted at Orlando 11 days after they had been removed from cold storage on December 20.

A second planting was made of bulbs of the varieties mentioned above that had been cold stored at 40° F. for 93 days, shipped to Bradenton and planted one day after removal from cold storage, January 6. All varieties flowered well but The Bishop produced more flowers than either Clara Butt or Scarlet Leader. They flowered on an average of about 42 days after planting. Similar results were gotten from bulbs of these varieties cold stored at 40° F. for 93 days, shipped to Orlando and planted five days after they had been removed

TABLE 1.—Effect of Storage Treatment on Average Number of Days from Planting to Flowering and on Percent of Flowers Produced by 3 Tulip Varieties, 1951-52.

Storage Treatment*	The Bishop		Scarlet Leader		Inglescombe Yellow		Treatment Summary	
	Days from Planting to Flowering	Percent that Flowered	Days from Planting to Flowering	Percent that Flowered	Days from Planting to Flowering	Percent that Flowered	Days from Planting to Flowering	Percent that Flowered
60 days at 40° F.	85	95.0	96	70.0	117	82.5	99	82.5
60 days at 50° F.	107	100.0	113	62.5	135	57.5	119	73.3
30 days at R. T. † 60 days at 40° F. **	82	95.0	87	77.5	106	57.5	92	76.7
60 days at 40° F. † 30 days at R. T. **	86	35.0	-	0.0	-	0.0	86	11.7
90 days at 36° F.	72	60.0	69	30.0	74	57.5	72	49.2
90 days at 40° F.	63	77.5	66	80.0	72	70.0	67	76.0
90 days at 50° F.	76	90.0	76	95.0	97	75.0	83	86.7
90 days at 60° F.	95	90.0	-	0.0	114	37.5	105	42.5
60 days at R. T. † 60 days at 40° F. **	75	65.0	79	52.5	99	25.0	84	47.5
120 days at 40° F.	48	52.5	50	90.0	50	75.0	49	72.5
120 days at 50° F.	50	92.2	52	87.5	65	77.5	56	85.8
120 days at 60° F.	73	75.0	-	0.0	90	25.0	81	33.3

*120 bulbs were used in each treatment, which was composed of 40 bulbs of each variety.

**Abbreviation: R. T. - Room temperature.

from cold storage, January 10. The Bishop and Clara Butt flowered well, but less flowers were produced by Scarlet Leader. It should be noted (Table 2) that, when bulbs of this variety had been stored at 40° F. for 90 days, removed from cold storage and kept at room temperature seven days before they were planted, flowering was greatly reduced.

Since cold-treated tulip bulbs flowered satisfactorily when planted in a warm greenhouse at Gainesville and outdoors at Bradenton and Orlando, it is reasonable to expect that bulbs similarly cold treated would flower satisfactorily if planted in extreme South Florida.

SUMMARY

Satisfactory flowering may be obtained within a storage temperature range of 40° to 50° F., and a time range of 60 to 120 days. If bulbs are cold stored only 60 days, however, they should be stored at 40° F. because of the extended time required for flowering if stored

at 50° F. Bulbs kept for as long as 120 days at 40° and at 50° F. flowered well. Thirty days warm storage preceding 60 days cold storage at 40° F. did not injure the bulbs but, when this period was extended to 60 days, flowering was significantly reduced.

Thirty days cold storage was not satisfactory at any temperature used—40°, 50° or 60° F.—and storage at 60° F. did not produce good flowering at any of the times used—60, 90 and 120 days.

Bulbs cold stored at 40° F. for 60 days can be kept at room temperature for at least seven days before they are planted without injury. When this storage time was increased to 90 days and the bulbs kept for seven days at room temperature before planting, flowering was reduced.

Bulbs of the varieties Scarlet Leader, The Bishop and Clara Butt, cold-stored for 66 and for 93 days at 40° F. and planted at Bradenton and Orlando, grew and flowered well.

TABLE 2.—Effect of 2 Cold Storage Times and 5 Dates of Planting after Cold Storage on Percent Flowers Produced by 3 Tulip Varieties, 1952-53.

Time of Planting*	The Bishop		Scarlet Leader		Clara Butt		Time Cold Storage (Summary)		Time of Planting (Summary)
	60 days at 40°F.	90 days at 40°F.	60 days at 40°F.	90 days at 40°F.	60 days at 40°F.	90 days at 40°F.	60 days at 40°F.	90 days at 40°F.	Percent Flowers Produced
Same day	95.0	90.0	90.0	90.9	97.5	92.5	94.2	90.8	92.5
Plant 7 days	97.5	77.5	82.5	20.0	80.0	55.0	86.7	50.8	68.8
Plant 14 days	85.0	47.5	20.0	7.5	70.0	32.5	58.3	29.2	43.8
Plant 21 days	37.5	22.5	10.0	0.0	35.0	2.5	27.5	8.3	18.0
Plant 28 days	5.0	0.0	2.5	0.0	0.0	0.0	2.5	0.0	1.3

*240 bulbs were used in each time of planting treatment, which was composed of 80 bulbs of each variety.