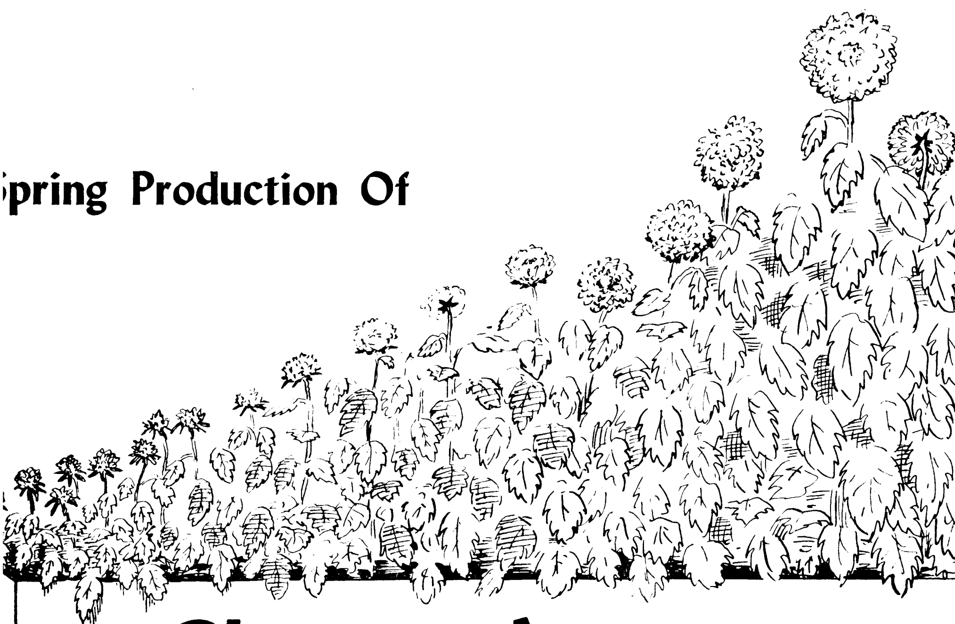
Agricultural Experiment Station
DIVISION OF AGRICULTURE
Oklahoma A. & M. College, Stillwater

Spring Production Of



China Asters

IN THE

Greenhouse in Oklahoma

by

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To Grow Good Asters

1. Sterilize all soil, benches, pots, organic matter and other materials to be used in aster culture.
2. Never allow plants to become checked in their growth.
3. Grow the fully double, wilt-resisitant varieties.
4. Stem rot may occur if the young plants are set too deeply in the soil when benching.
5. Allow a 6 x 8 to an 8 x 8 inch spacing if you intend to flower 5 strong stems per plant.
6. Keep nutrient levels as follows: Nitrates, 25 ppm; phosphorus, 5 ppm; potassium, 20 ppm; and calcium, 150 ppm. pH should be 6.0 - 7.5.
7. Practice a strict insect control program. Red spiders, aphids, and worms multiply quickly under greenhouse conditions in the spring.
8. Apply supplemental lighting for a *minimum* period of 8 weeks from a January sowing.
9. Disbud laterals for better quality.
10. Try single-stem asters for excellent size and quality.

CONTENTS

Methods for Growing Spring Asters 5

Varieties 5

Temperature 6

Seeding and Transplanting 6

Soil Preparation and Sterilization 6

Fertilizers 6

Supports 7

Spacing in the Bench 7
Normal, Single Stem

Lighting Schedule 7

Control of Pests 8

Report of the Research 8

Review of Literature 8

Procedure 9

Results and Discussion 10

Literature Cited 14

Spring Production of China Asters In the Greenhouse in Oklahoma

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Production of China asters *(Callistephus chinensis)* for flowering in April, May and early June offers welcome variety to the wholesale market. The retail grower can produce spring asters over a long period for his own shop by making successive sowings.

With the large influx of year-'round chrysanthemums now on the market, the China aster, if produced in moderate quantities (one or two benches flowering at a time for the retail grower), can be a valuable crop in the spring season.

Research to determine the best lighting methods for producing a spring crop of good quality China asters in Oklahoma greenhouses was started at the Oklahoma Agricultural Experiment Station in 1951 and continued through July, 1954. This bulletin reports the results of the four seasons' trials, and also gives practical suggestions based on the experience of Station floriculturists who did the research.

METHODS FOR GROWING SPRING ASTERS

Recommendations resulting from this research are summarized in the following paragraphs.

Varieties

Azure Ball proved to be the most vigorous and strong-growing variety among those used in the tests. Others which were grown were Royal White, Royal Azure Blue, Ball Deep Rose, Ball White, and Pink Ball.

* The research reported herein was initiated by Rayford Houston, formerly floriculturist on the staff of the Department of Horticulture.

Temperature

A night temperature of 55° F. was maintained until normal outdoor temperatures became too high in May and June. Asters will do well in a cooler house where carnations and snaps are being grown (night temperature of 50° F.).

Seeding and Transplanting

Sterile vermiculite or a mixture of soil and vermiculite make good seeding media for asters. Excellent seedlings can be obtained by sowing seed in rows in vermiculite and, after germination, applying a light liquid feeding of a soluble complete fertilizer. The seedlings are easily transplanted from the vermiculite with roots intact. The seed flats are conveniently watered by sub-irrigation trays.

Do not sow seed too thickly in the row or weak seedlings will result.

When the first true leaf appears, the seedlings should be transplanted to 2½-inch pots which have been sterilized. Do **not** let the young plants remain in the small pots so long that they become hardened and checked in growth. Bench no later than four or five weeks after transplanting to the small pots.

Soil Preparation and Sterilization

Asters will do well in a good, well-drained mixture of three parts soil and one part well-rotted manure, peat moss, or other decomposed organic matter. One part sand should be added if the soil is heavy. A pH of 6.0 to 7.5 is desirable. A 2-inch layer of well-rotted manure worked into the existing bench soil is a sufficient amount of organic matter. The bench should be steam sterilized (180° F. for 30 minutes) to prevent the possibility of an outbreak of Fusarium wilt or other serious disease, and to kill weed seeds.

Apply five pounds of superphosphate per 100 square feet of bench area before planting time.

Fertilizers

Asters are not too demanding in fertilizer requirements, but they should be kept actively growing and unchecked. Maintain nutrient levels as follows: nitrates, 25 ppm; phosphorus, 5 ppm; potassium, 20 ppm; and calcium, 150 ppm. Use of soil tests as a guide in fertilizer applications. Avoid strong fertilizer applications in the seedling stage. It is better to apply a weaker solution at more frequent intervals.

Supports

A mesh support as used on carnation, pompom mums, etc., is satisfactory for aster benches.

Spacing in the Bench

Normal.—A satisfactory spacing in the bench for asters is 8 x 8 inches. This spacing is ample to insure good development for the laterals and production of five good flowers per plant. For better quality, prune off excess laterals. At closer spacing, the laterals will be shaded and crowded to such an extent that the resulting stems are thin and weak, most of them being unsalable. Laterals should be disbudded for best quality. Pinching is not necessary to induce branching.

Single Stem.—Single stem asters of excellent quality can be produced by spacing the plants 4 x 4 inches and disbudding, leaving only the terminal flower bud. Uniformity in size and quality result, each stem being good and the flower salable. Very few weak or short stems develop. This method takes more seedlings, but quality is assured. The crop will be cut over a shorter length of time than when the laterals are flowered.

Each 16 square inches of area produces a flower at this spacing. Normal 8 x 8 inch spacing—flowering five blooms per plant—takes only 12.8 square inches per flower; but quality is not as high.

Lighting Schedule

By successive sowings of seed through the month of January, asters of excellent quality can be produced in Oklahoma when a **minimum period of eight weeks of** supplemental lighting is used. A schedule for a January sowing grown at 55° F. night temperature is as follows:

Sow seed -- January 1.
Start lights -------- January 8 (lights on at 5:00 p.m., off at 10:00 p.m.).
Transplant to 2½-inch pots when first true leaf appears.
Bench ---------------------------- 4 to 5 weeks after transplanting.
Stop lighting -- March 4.
Flowering date ---------------------------------- April 15 to May 5.

It is necessary to continue the lighting period until there is sufficient stem length to insure production of salable asters.

A light shade should be kept on the greenhouse from March through flowering. Too much shade will cause weak, spindly growth.

For increased stem length, light from January 8 until flowering. Blooming date will be May 1 to May 15, which is slightly later than for those plants lighted eight weeks.

Control of Pests

Insect pests and plant diseases attacking greenhouse asters can be controlled as follows:

PEST	CONTROL
Insects	
Red spider mites	Aramite spray or Aerosol bomb. Dithio bomb. (Parathion may cause leaf injury.)
Aphids	Lindane spray or dust.
Thrips	Lindane spray or dust.
White fly, leafhopper, leafroller, worms	DDT spray or dust.
Diseases	
Wilt	Steam sterilize soil, benches, pots, seed flats, etc.
Leafspot	Fermate, parzate, or zerlate spray. Do not syringe overhead.
Yellows	DDT sprays as to control leafhopper.

REPORT OF THE RESEARCH

The studies reported herein were conducted primarily to develop a lighting schedule for producing a greenhouse crop of China asters in Oklahoma during May and June when the supply of cut flowers in this state is usually insufficient. Incidental observations were made on varieties and methods of production.

Review of Literature

Research by Garner and Allard (4) * in 1920 established the fact that length of day affected the time of flowering and growth of plants. Laurie and Poesch (9) found that China asters responded favorably to increased illumination during the winter months. Plants given additional electric lighting produced an average of six flowers per plant and averaged 13.4 inches in stem length. The plants in the check plot formed rosettes of leaves and did not flower. Green, Withrow, and Richman (5) noted that China asters lighted in the

* Numbers in parentheses refer to Literature Cited, page 14.

seedling stage for two or three months during the winter season flowered satisfactorily. They also obtained earlier flowers and increased flower production when Early Royal Purple asters were illuminated in the seedling stage with a 50-watt lamp for 10 hours each night for a period of 26 days during the summer season.

Withrow and Richman (16) produced the best quality flowers during the winter months with the variety Heart of France when irradiated from a little after germination to the time of the appearance of flower buds. Lighting for a shorter period of days induced earlier flowering, but the blooms were abnormal and borne on short stems. In this experiment, a lighting period of five hours gave as good results as a 10-hour period. Laurie and Poesch (11) determined from their work that additional light should be applied from 5:00 p.m. to 10:00 p.m. or from 2:00 a.m. to 7:00 a.m. during fall and winter. They further noted that low-wattage lamps (25 to 40) suspended two feet above individual benches (4 or 5 feet wide) and spaced four feet apart were sufficient for asters during the lighting period.

Post (13) noted at Ithaca, New York, that China aster plants rosetted from September 1 to May 1 if they were grown at a temperature between 50° and 65° F. After May 1 the stems elongated and flowers developed. He also found that use of artificial light during the short days from September to May prevented rosetting and caused elongation of the plant stems followed by flower bud formation and development. McElwee (10) indicated that lighting in the seedling stage started seven days after a February 3 sowing and continued for four weeks was more satisfactory than a 6-, 7-, or 8-weeks lighting period. The most effective treatment for plants seeded February 17 consisted of lighting for eight weeks from date of seeding to April 14. A 6-weeks lighting period was almost as effective as the 8-weeks lighting period with the February 17 seeding. Using early and midseason varieties, ,he obtained flowering from May 7 to June 12 when additional lighting was applied. All of the foregoing work was done under northeastern and southeastern conditions. Little research has been done on greenhouse forcing of China asters in the south and southwest.

Procedure

Methods used in growing the plants were those outlined in the preceding section of this bulletin. Three varieties were seeded at monthly intervals, on the first day of January, February and March each season, except 1951 when only one variety was seeded.

Liquid applications of ammonium phosphate and muriate of potash applied through a "Hozon" applicator were used in the tests to maintain proper nutrient levels. (See page 6 for necessary nutrients.)

After the seedling emerged, they were separated into five lots to receive additional lighting (5:00 p.m. to 10:00 p.m. daily) for periods of two, four, six and eight weeks, with the fifth lot receiving no no additional light.

In 1954, an additional plot was included for each of the earlier sowings (January and February). These plots were lighted until the plants flowered.

Results and Discussion

Results for the three seasons 1952-1954 are averaged in Table I.

Striking differences in size between lighted and unlighted plants started showing up shortly after transplanting of seedlings from the seed flat to 2½-inch pots. The plants which received five hours of additional light each day soon outgrew those receiving no additional light, and plants which received four weeks of supplemental lighting were larger at benching time than those which received two weeks of light. These differences are particularly evident in the January sowings. As the days became naturally longer in the spring and the day temperatures higher, there was less difference noted in size in the young plants.

After the plants were benched, the unlighted plants grew more slowly than the lighted ones and developed the typical rosette type of growth, failing to elongate properly due to short photoperiod (See Figs. 1 and 2). In contrast, the lighted plants showed elongation of the terminal and lateral growth (See Figs. 3 and 4).

TABLE I.—Effect of Varying Periods of Supplemental Lighting* on China Asters

(Averages of all sowings for three seasons, 1952 through 1954.)

Supplemental lighting period	Length of stem (inches)	Flower diameter (inches)	Earliest day cut, before check	Last day cut, before check
None; check	19.0	2.67	--	--
Two weeks	12.2	2.95	41	13
Four weeks	14.4	2.99	32	24
Six weeks	14.0	3.27	36	22
Eight weeks	19.0	3.35	33	17

* Lights turned on at 5:00 p.m., off at 10:00 p.m.

Fig. 1

Fig. 2

Figures 1 and 2 show asters having supplemental lighting for periods of: (1A) no light; (1B) two weeks; and (2) four weeks. All plants were sown January 1. The unlighted plants grew more slowly than the lighted ones and developed the typical "rosette" type of growth, failing to elongate properly due to short photoperiod.

Fig. 3

Fig. 4

Asters in Figures 3 and 4 have been lighted for six and eight weeks, respectively. The plants were sown January 1. The greater extent of axis elongation, length of lateral branches, and flower bud formation can be seen as compared to Figures 1 and 2. It was found that if seed were sown in January, the lighting period must be at least eight weeks in duration to produce flowers on stems of sufficient length.

Fig. 5

Figure 5 (A, B, C and D) illustrates that long photoperiods cause axis elongation followed by flower bud initiation, and short photoperiods after bud initiation speeds flower development. "A" shows the typical growth of plants receiving no supplemental lighting or only short periods of it. Plants to the right are the Azure Ball aster, a variety which showed more vigor in early growth than the other varieties tested. "B" is the 6-weeks lighted plot (Jan. 8 to Feb. 18). The lighting period produced axis elongation and flower bud development; however, the flowers are borne on stems too short for marketable quality. "C" shows the 8-weeks lighted plot (Jan. 8 to Mar. 4). The stems have elongated and the plants are just beginning to flower. "D" shows the continuously-lighted plot (Jan. 8 to flowering). Notice that the blossoms are still less advanced than those in "C". All pictures were taken April 12.

It was found that if seed were sown in January, the lighting period must be **at least eight weeks in duration** to produce flowers on stems of sufficient length. (Plants from a **January sowing** receiving six weeks of light had an average stem length of 17.8 inches and an average diameter of 3.3 inches.)

In the 1954 tests, a plot was included in which the plants were lighted continuously until flowering. Quality was excellent (23 inch average stem length), and flowering time was 10 days to two weeks later than in the plot lighted for eight weeks.

Figure 5 (A, B, C, and D) shows the relative differences in stage of growth of aster plants from a January 1 sowing given lighting treatments of: no or only short periods of additional lighting; six- and eight-weeks lighting; and continuous lighting. (All photographs were taken April 12.) The pictures illustrate that long photoperiods cause axis elongation followed by flower bud initiation, and short photoperiods **after bud initiation** speeds flower development (compare B, C and D as to flower development).

Fig. 6

Figure 6 illustrates that longer lighting periods will result in longer stems and delayed flowering. The 6-weeks lighted flower (left) is past its peak of quality and freshness; the 8-weeks lighted flower (center) is fully open, but not old; the continuously-lighted flower (right) is still in the bud stage, its stem still in a process of elongation.

The data show that eight weeks of supplemental lighting was the minimum necessary for production of asters with stem length sufficient for salable quality during the late April, May, and early June period. The lighting period may be extended for longer periods than eight weeks, with the result that longer stems will be produced, though flowering will be delayed to some extent (See Figure 6).

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