least 125 days, even though infection occurred in 100% of the plants.

Races of the pathogen and susceptible host genotypes may interact differently under different soil conditions. Hickman and English (3) found that soil type affected their results greatly. Some alkaline soils were conducive to *P. fragariae* infection and disease development and others were not. They concluded, as was found here, that there was not a direct relationship between soil pH and red stele disease development. Consequently, the consideration that cultivars normally susceptible to *P. fragariae* can persist in infested soil but show minimal disease symptoms may be valid as was observed with *P. fragariae* race A-5. Under these conditions susceptible plants might be mistakenly rated as highly resistant to the disease in a screening test. In the field the pathogen could conceivably be transferred from one field location to another in propagation material that appears to be disease free.

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Observations on Vegetative and Reproductive Growth in Blueberry[1]

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Additional index words. Vaccinium corymbosum, wood thickness, flower buds, vegetative buds, growth flushes, bud location

Abstract. **Earlier ripening cultivars of blueberry (*Vaccinium corymbosum* L.) usually produced more vegetative growth flushes than later ripening cultivars. Multiple flower buds were found most frequently on thick wood regardless of cultivar. Most distal buds on any flush were flower buds, while proximal buds were usually vegetative.**

The growth and fruiting habits of the cultivated highbush blueberry have been reported by several researchers. These include the frequent occurrence of 2 flushes of vegetative growth in 1 season (3, 6, 8) and the formation of single, axillary flower buds on the distal portion and vegetative buds on the proximal portion of the new growth (1–6). Shutak (8) reported the formation of double flower buds on 'Coville' bushes sprayed with 5000 ppm succinic acid-2,2-dimethylhydrazide (SADH). Observations on the no. of flushes, the order of flower and vegetative bud succession along the shoot, and the frequency of occurrence of multiple flower buds are reported below.

Observations were conducted during March, 1975, on bushes of 'Earliblue', 'Herbert', 'Bluecrop', 'Coville', 'Bluetta', and 'Lateblue' growing under a sawdust mulch on Narragansett loam soil. All bushes received 1 kg of 5N-4.3P-8.3K fertilizer annually. Shoots were separated into 3 thickness classes as previously described by Hindle et al. (7). Ten medium-thick shoots per bush on each of 5 bushes of each cultivar were observed in relating the no. of flushes to cultivar. Five shoots of each thickness per bush on each of 5 bushes of each cultivar were used in relating the occurrence of multiple flower buds to shoot thickness and in determining bud type locations. Any bud that did not have the typical spheroidal shape of flower bud was considered a vegetative bud. Data for relating growth flushes to cultivar are expressed as total no. of flushes occurring on 10 shoots per bush per cultivar.

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Table 2. Occurrence of multiple flower buds (25 shoots per cultivar).

Cultivar	No. of multiple flower buds: Thin wood	Medium wood	Thick wood	Means[z]
Earliblue	0	5	48	17.7 a
Bluecrop	0	3	13	5.3 a
Coville	2	1	33	12.0 a
Means	.7 a	3.0 a	31.0 b	

[z]Mean separation within rows or columns by Duncan's multiple range test, 5% level.

In most cases, the later the season of fruit ripening, the lower the incidence of multiple flushes (Table 1). This relationship appeared to breakdown somewhat, however, in the case of 'Lateblue', which behaved similar to a midseason rather than a lateseason cultivar.

Flower buds were interspersed with vegetative buds on all flushes and not merely on the distal portion of the new shoot. Though most buds were single, the appearance of multiple flower buds was not uncommon and was found

Table 1. Relationships of growth flushes on medium thick wood to 6 blueberry cultivars.

Bush	No. growth flushes per 10 shoots: Bluetta[z]	Earliblue	Bluecrop	Herbert	Coville	Lateblue
1	17	14	13	15	10	14
2	20	15	16	13	11	15
3	19	21	18	17	10	11
4	19	22	15	16	10	17
5	19	13	14	12	10	20
Mean	19.6 a[y]	17.0 ab	15.2 b	14.6 b	10.2 c	15.4 b

[z]Cultivars listed in order of fruit ripening, early to late.
[y]Mean separation by Duncan's multiple range test, 5% level.

Table 3. Relationship of growth flush to distal and proximal bud type.

Wood type	Location	Earliblue: No. flower buds	Earliblue: No. vegetative buds	Bluecrop: No. flower buds	Bluecrop: No. vegetative buds
Thin	End flush 1	22.00	3.00	22.00	3.00
	Begin flush 2	1.00	24.00	1.00	24.00
Medium	End flush 1	22.00	3.00	25.00	0.00
	Begin flush 2	0.00	25.00	0.00	25.00
Thick	End flush 1	4.00	21.00	7.00	18.00
	Begin flush 2	0.00	25.00	3.00	22.00

[z]Data taken on 25 shoots of each shoot thickness.

to be related to shoot thickness on 3 cultivars (Table 2). Thick shoots had significantly more multiple flower buds, in some cases up to 7 buds per node, than did thin or medium-thick shoots. This trend appears independent of cultivar.

On thin and medium-thick shoots of 'Earliblue' and 'Bluecrop' having 2 growth flushes, the distal bud on each flush was nearly always a flower bud, while the proximal bud on the 2nd flush was nearly always a vegetative bud (Table 3). Thick shoots did not consistently display this trend.

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Effect of Temperature on Pecan Seed Germination[1]

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Additional index words. Carya illinoensis

Abstract. **Embryo growth of the pecan (*Carya illinoensis* (Wang.) K. Koch) is mechanically restricted by the shell. This effect can rapidly be overcome by germinating the seeds between 30 and 35°C.**

Various papers have reported that stratification for 3 months at 5°C is a means of ensuring uniform and rapid germination of pecan nuts (1, 3, 4). We investigated the effects of both high and low temp on germination in view of the long period required for stratification and the fact that the pecan has a high growing season heat requirement.

Seeds (nuts) of 'Curtis' pecan, a rootstock cultivar widely grown in Southern Africa, were used in the present investigation. Harvested nuts were dried at ambient temp for 2 months. Germination experiments were carried out in plastic trays containing perlite moistened with a 0.1% captan [N-(tri-chloromethylthio)-4-cyclohexene-1,2 carboximide] solution. Each tray containing 50 nuts was covered with glass to ensure a high humidity around the nuts buried in the substrate. All experiments were repeated and treatments replicated 3 times. Germination was recorded every second day, and regarded as completed when the radicle was sufficiently elongated to show geotropic curvature (Fig. 1).

Nuts were buried in moist perlite and for stratification maintained at 4°C for 3 months.

Various reports have shown that scarification (2) and stratification (1, 3, 4) treatments improve pecan germination. However, the optimum germination temp has not been established. Intact nuts and excised embryos were incubated at 20°, 25°, 30° and 35°C. It can be seen in Fig. 2 and 3 that the presence of the shell retards germination irrespective of the germination temp. Presence of the shell, which is freely permeable to water and gases and exerts its effect by mechanically restricting the growth of the radicle (5), is more pronounced at lower temp. Intact nuts germinated uniformly and rapidly when incubation temp were raised to between 30 and 35°C, commencing about 6 days after inbibition and reaching maximum germination (95%) after 20 days (Fig. 2). Similar results were obtained with non-stratified nuts taken from the tree at first shuck dehiscence or nuts that were stored dry at low temp for 8 months. Stratification enhanced germination in agreement with previous reports (1, 4, 5). It was significant, however, that nuts stratified for 3 months germinated as rapidly at 20° and 25° as at 35° (Fig. 4). It would appear that the prolonged period of stratification allowed the embryos to mobilize their lipid (± 70%) and/or carbohydrate (± 10%) reserves, thus

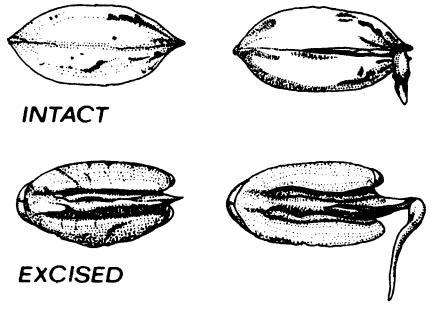

Fig. 1. Germination criterion for intact nuts and excised embryos. (Left, before germination; right, after germination.)

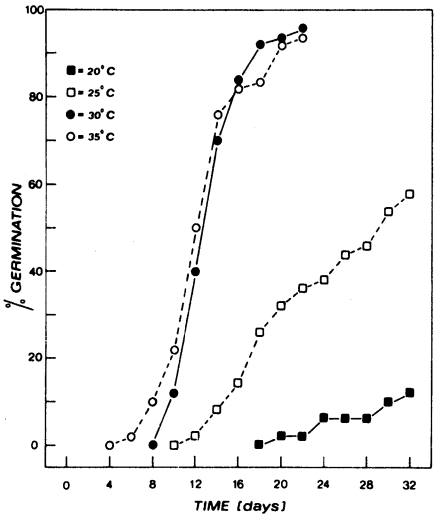

Fig. 2. Germination of non-stratified pecan nuts at different temp.

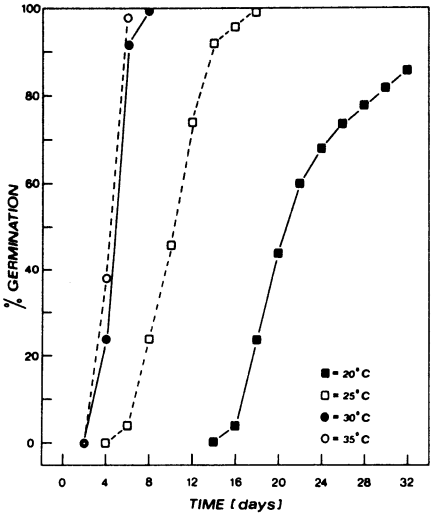

Fig. 3. Germination of excised pecan embryos at different temp.

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