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The spraying apparatus mentioned by Prof. Pammel, in another portion of this bulletin, is adapted to much of this work, and his paper may profitably be consulted in this connection.

BLOSSOMS OF THE ORCHARD FRUITS.

J. L. BUDD.

THEIR RELATIVE HARDINESS.

The observations of the past thirty years on the prairies west of Lake Michigan sustain the proposition that the varieties of the orchard fruits vary in hardiness of fruit buds and blossoms quite as much as they do in relative hardiness of tree. The proposition can also be sustained that the typical Ironclad tree has hardier fruit buds and blossoms than the one that poorly withstands our trying changes of summer and winter. With the apple this is well illustrated in watching the behavior of such Ironclads as the Blushed Calville, Anisette, Duchess, Borovinca, Hibernial, Recumbent, Anis, Ostroff, and many others from the steppes of east Europe.

During our trying summers they retain clean, healthy foliage and in early autumn ripen their leaves and points of growth prior to the advent of severe frosts as do our native forest trees.

Hence they are able to store the needed nutriment for starting vigorously the new growth in spring, and for the full development of the blossom buds and blossoms, with still enough in reserve for holding and starting into growth the young fruits. If frosts occur during the blossoming period they usually escape damage apparently on account of their superior amount of stored starch, inherent vitality, and not least the superior thickness of the calyx tube to which the ovary adheres. Of course these can only be given as probable reasons, but the fact remains that the blossoms of such Ironclads have retained perfect ovaries and set full crops of fruit in low, frosty positions, where every apple blossom of less hardy varieties on higher and less frosty ground was destroyed.

If we observe closely such less hardy varieties as Walbridge, Perry Russet, Tallman Sweet, and Gros Pomier, we find them hardy in fruit bud and blossom on bluff lands or high prairie ridges where the wood ripens perfectly in autumn, but on lower and richer prairie soils the blossoms suffer as much as those of less hardy sorts such as Ben Davis or Grimes' Golden. While it is true that the lower position may be more frosty, it is yet true beyond all doubt that the imperfect ripening of the cell structure of the wood and inner bark has much to do with the vigor and hardiness of the fruit bud and blossom. On specially favorable soils, such as the high loess bluffs of the Missouri, even varieties as tender as Jonathan and Fulton, may so perfectly ripen their wood and fruit buds as to render the blossoms practically as hardy as those of the Duchess on less favored soils. But such favored spots are rare in the state and we are compelled to seek the varieties that live and bear on our great expanses of rich drift prairie soil.

With the cherry we find the same variation in hardiness of tree, fruit bud, and blossom. On soils favorable for the perfect ripening of the wood in the south half of the state, the Early Richmond, Late Kentish, Montmorency, Dyehouse and English Morello, have fairly hardy fruit buds and blossoms. But on rich prairie soils the crop is always a failure after a hard winter followed by frosts at the time of blossoming. In 1887 the conditions were so unfavorable that not a solitary cherry of the old varieties was seen in this vicinity and but few wild plums, and the same was true over nearly the entire state. Yet the blossoms of the hardiest Russian and North Silesian cherries were unharmed and they matured a full crop of fruit. The flowers of these varieties expose the ovaries above the calyx like our common sorts, but they are stronger in all their parts and the thick calyx around the ovary affords some protection. Yet the main cause of their superior hardiness of fruit bud and blossom is probably found in their more perfect cell structure and inherent vigor and strength. This season the heavy frosts of the first days of May destroyed the blossoms of the Early Richmond and all other west European sorts except on some high ridges in the vicinity. The blossoms of the native plums are also mainly ruined. Yet our hardy cherries promise to bear the usual load of fruit.

I might add that some of the Silesian and South Russian cherries have an additional provision for escaping untimely frosts as they bear two distinct sets of blossoms. When the trees are white with bloom the buds on a part of the clusters are still unopened. If the first set is destroyed by a freeze, the latter ones are numerous enough for a full crop. If both sets mature fruit we have two crops of fruit fully two weeks

apart, as we have had for the past two years, and are likely to have this year. Last year we picked a fine crop of the Brusellar Braune cherry about the 15th of August, and a part of the second was shown in perfect condition at the State Fair the first days of September. All of the North Silesian and South Russian cherries extend the time of blossoming over a period of from one week to twelve days, while the varieties from southwest Europe expand all the blossms at about one time. Our native plum blossoms of the best varieties are remarkably hardy in fruit buds and blossoms. But the ovaries are exposed and are liable to be killed by a temperature of 27° Fahr. But they vary in hardiness. On the College grounds a freeze that kills the ovaries of the Speer, Rollinstone, Maquoketa, Forest Rose, and Pottawattamie injures only a part of those of the De Soto, Wolf, Wyant, and Cheney. In estimating the value of a new variety, this should be taken into consideration.

In this vicinity we have no trees left of the Lombard, or any other variety of the west European plums. But their past record has put them in the tender list as to fruit buds and blossoms. The Russian plums have their ovaries more exposed than those of the Russian cherries, but less than our native plums. With the same exposure the blossoms of the Early Red, Yellow, Maldavka, Long Red, Long Blue, Hungarian, and other sorts, are in better condition than those of the De Soto. This is the first real test, as four years ago we had only the native plums in bearing to any extent and all were cut off by frost, including the native plums on our timber borders.

The Russian apricots and *Prunus Simoni* have very fragile and tender blossoms. We can only hope to secure crops from them where the trees are hardy, when the springs are peculiarly favorable. So far their blossoms have proven tenderer than those of the North China and Bokara peaches, and these are not hardier than those of the Early Richmond cherry.

The hardiest Russian pears, such as Nos. 347, 391, 392, 122 and 508, seem to be as hardy in fruit bud blossom as the Duchess or Hibernial apples. On young trees the scattering clusters produce specimens of fruit with as much certainty as our native crab-apples. This season they were expanded when the temperature reached 27°, yet so far as noted not a blossom was injured.

CROSS FERTILIZATION.

Evidence is constantly accumulating in favor of Darwin's settled conviction that nature does not favor the self-fertiliza-

tion of plants. The strictly solitary stalk of corn, chestnut tree, or forest tree, is not apt to fruit even fairly well, if at all. Among our cultivated fruit trees in our climate we find that self-fertilization is often impossible, as the pollen is ripened and wasted before the stigmas are ready for fertilization. This is now quite generally known in regard to the Miner plum, but does not appear to be suspected as an existing principle among our small fruits and orchard fruits. But recent observations in this county and Europe favor the belief that blocks of any one variety are not advisable with any of the cultivated fruits, not excepting even the Duchess apple, the De Soto plum, or the Concord grape. In some cases fair crops may be secured in this way, while in others the resulting crop will not pay for the care bestowed. This is specially true of nearly all varieties of the stone fruits.

Where possible, varieties should be alternated in the rows, giving all possible attention to the season of flowering.

As a whole, the point I wish to make in this paper is that the character of the fruit bud and blossom has much to do with the value of any variety, and that as yet, too little attention has been given in our state or the west to this important subject.

SOME OBSERVATIONS ON CONTAMINATED • WATER • SUPPLY FOR LIVE STOCK.

M. STALKER.

There is no fact better known to the sanitarian, than that one of the chief sources of danger to life and health, is the contamination of drinking water. If a malignant form of fever makes its appearance in a family, which cannot be explained by the history of actual exposure to contagium, the water supply always comes in for an early and liberal share of attention. The instances are sufficiently numerous in which the investigator is enabled to trace the malady to this source, to warrant every reasonable precaution in procuring