VARIATIONS IN THE NODES OF *Vitis vinifera* L.: DOUBLE COMPOUND BUDS

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Buds in *Vitis vinifera* L. grow from meristems at the axils of leaves and scales soon after the latter separate from the apical meristem of the shoot (Pratt 1974). Depending on order of appearance at a node and subsequent development, grapevine buds fall into three categories: (a) the prompt bud which forms first and from which the summer lateral develops, (b) the primary bud which is subtended by the prophyll (scale-like structure) at the basal node of the summer lateral, and (c) the secondary buds which are borne opposite each other at the axils of the two basal prophylls of the primary bud. The summer lateral may produce many leaves and inflorescences or it may abscise above the prophyll leaving a scar (Goffinet 1991; Pratt 1974). The primary and the two secondary buds develop enclosed by the basal prophyll of the summer lateral and the two basal scales of the primary bud and constitute the prominent latent (overwintering) compound bud from which the following season's shoots and clusters grow (Galet 2000; Pratt 1974). To avoid the ambiguity of the multiple names of the different bud types, the system proposed by Bugnon and Bessis (1968) and recommended by May (2000) is also used here. In this system the shoot itself is called N, the summer lateral is N+1, the primary bud is N+2 and the secondary buds $N+3_1$ and $N+3_2$. Shoot phyllotaxy in each new branching order is perpendicular to that of the preceding one (Figure 1A).

It is also understood in the literature that only one compound bud develops at each node as "The summer lateral is characterized by one basal prophyll and a long internode between this and the first foliage leaf" (Pratt 1974). However, a morphological deviation in this arrangement has recently become evident and will be described next.

Bud dissections of dormant buds and in-season observations in 25 to 30 California commercial wine grape vineyards from 2004 to 2006 have shown that the summer lateral (N+1) can produce two basal nodes each bearing a compound bud complete with primary (N+2) and secondary buds (N+3). These double buds are aligned perpendicular to the plane of phyllotaxy of the main shoot (N). This phenomenon is observed mostly in the proximal nodes of the N shoot in which the summer lateral (N+1) does not persist (Figure 1C), although in a few cases persistent N+1 shoots are found bearing double compound buds at their base (Figure 1B). In most cases one of the double buds is slightly smaller and less developed and fruitful than the other and bears very small N+3 buds. The prophyll subtending each compound bud grows sufficiently to cover most of each bud, but in some cases the prophyll from the larger bud may almost completely cover both buds making the entire structure appear as one normal bud. This arrangement can be distinguished from normal buds by the phyllotaxy of the enclosed buds and by the absence of the adjacent N+1 scar.

The N+1 scar, which in normal nodes is readily seen on one side of the bud and just above the leaf scar, can be found tucked between the double buds (Figure 1C). Frequently, dead tissue from the abscised N+1 shoot remains trapped between the buds and may be wrongly identified as early-occurring primary bud necrosis (PBN) of a normal normal bud in which the N+3 buds have developed well. However, contrary to the alignment of N+2 buds in double bud arrangement, the alignment of N+3 buds in normal buds (with or without PBN) is always parallel to the plane of phyllotaxy of the main shoot (Figure 1A).

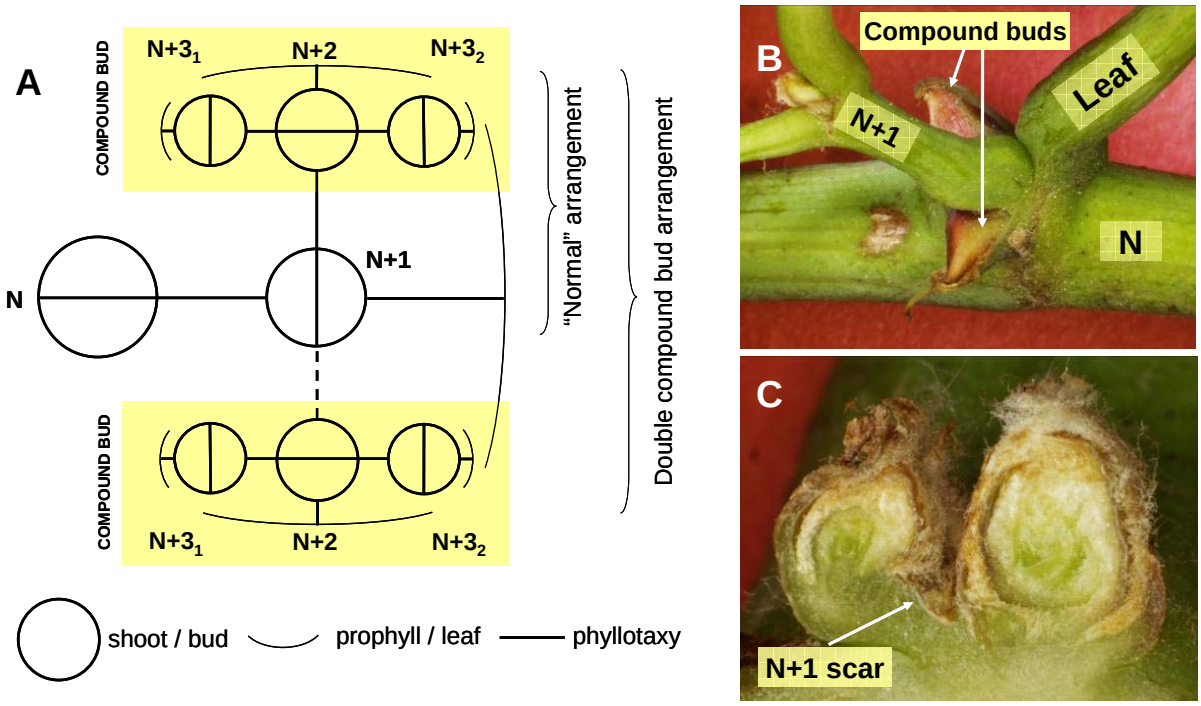
The number of proximal nodes bearing double buds seems cultivar-dependent with Pinot noir having the most (up to 15 nodes) followed by Cabernet sauvignon, Syrah, Merlot (one or two basal buds) and Chardonnay (occasionally). Therefore, many of the retained nodes at pruning may bear double buds since these varieties are usually spur-pruned in California. Double buds have been absent in the observed Thompson Seedless and Fiesta vineyards. A one-time examination of dormant buds in a variety collection found no double buds in Zinfandel, Arneis and Tempranillo.

Although individual nodes bearing double compound buds have not been followed up through bud break, it is very likely that some of the multiple shoots observed in the nodes of some varieties originate when both double compound buds grow. The bases of these shoots are usually aligned in the same plane of phyllotaxy as the N+1 shoot.

Generally, the larger bud in the double compound bud arrangement can be as fruitful as normal compound buds. Tagging and follow up of individual nodes with double and normal buds in the same vine should reveal any differences in yield components.

Further screening of different varieties in various regions would be necessary in order to characterize the range of occurrence of double compound buds. Scoring of buds for PBN can gain more precision by awareness of the occurrence of double buds.

Figure 1. (A) Schematic top view of the arrangement of appendages in nodes bearing normal and double buds (B) Double compound bud in Chardonnay at node 5 with a persistent summer lateral (N+1) (C) Longitudinal section of double compound buds in Chardonnay two weeks after berry set at node 2. The N+1 shoot abscised very likely before or around bloom of the current season.



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