



Tulip Planting Depth in the Landscape...The Final Word

This newsletter is a final update to the topic of tulip planting depth in the landscape. The original newsletter, No. 37 (June 2017), was a preliminary report and with the 2018 season, the final data in this experiment have been collected. The original conclusions from last year have not changed: deep planting of tulips, as recommended by most packages and websites, is detrimental to longer term perennialization potential. If consumers want the best chance to perennialize tulips, or simply want to plant them with less effort, shallower planting should generally be advised.

If the customer seeks out information, what do they find? If they read many bulb packages or check websites, they will generally be instructed to plant tulips in holes that are *at least* 8" (20 cm) deep. Furthermore, if you Google "How deep should I plant tulip bulbs", most sites will tell you to plant them "8 inches deep", and some even advocate "loosening soil to a depth of 12-15" (Table 1). While mostly unsaid, it seems the prevailing idea is that "deeper is better". In this newsletter, we'll always refer to planting depth as "how deep the hole is"...which is the same as the depth of the bottom of the bulb.

Why are the recommendations to plant so deep? The main view is that "temperatures are more uniform deeper in the soil" and this is somehow good for the bulbs. What this fails to account for is that tulips are native to snow-covered gritty soils, moist cool springs and dry and generally hot summers. They certainly did not evolve under conditions of uniform soil temperature! Winter damage can of course be another reason.

In many soils, digging an 8" deep hole is tough work. Digging enough 8" holes to plant 100 bulbs, or excavating a single planting area for 100 bulbs is truly a back breaking task.

No doubt about it, gardening is good, healthy exercise, and avid gardeners enjoy being outside and the labor involved in planting bulbs. But, can we make bulb planting any easier?

Can we come up with ways to make it easier for people and perhaps better for the bulbs? Can we find methods that might allow more people to plant more bulbs more often without sacrificing their long-term potential in the garden? Perhaps this newsletter, which highlights an old method, might offer at least one solution.

I say "old method" because years ago Gus De Hertogh (1993) did trials on a similar "top planting" method, collaborating with a landscape architect in North Carolina. He described a "modified mulching system" for spring flowering bulbs that involves much less digging.





In it, the bed is tilled to a depth of 4" then bulbs placed on top of the soil and covered with 5-8" (12.5-20 cm) of lime-amended mulch. This system has a distinct advantage of less digging, and is highly amenable for larger-scale landscape bed installations.

Based on a meeting with dry-sale exporters in Holland in June 2008, it was decided to install longterm experiments to study planting and mulching depth on perennialization of tulips. Since then, we have done 6 experiments, installed in 6 different years, each one maintained for 3 years to follow perennialization (return and persistent flowering).

Recommended depth of hole	Comments
5-6"	Cover the top bulb with 3-4" of soil (so, the depth of the <i>hole</i> would be 5-6"
8-10"	Plant smaller ones, like species tulips, 5-6" deep
8" (20 cm)	Much unfocused discussion about planting depth
6-8"	"If you add mulch, include this as part of your overall planting depth"
6-8"	Hybrid tulips
3-5"	Species tulips
6"	2-3 times the height of the bulb. Smaller bulbs would be 3-4" deep
At least 8"	Loosen soil to depth of 12-15" (!!!)
5 to 8"	Include depth of the mulch
6"	On heavy clay soils

Table 1. Results of a May 2018 Google search for "tulip planting depth".

What We Did

Negrita and Parade were used. These cultivars were selected based on trials done by Dr. Paul Nelson in North Carolina in the early 1980s that suggested both were "good perennializers". That full report is available at https://content.ces.ncsu.edu/spring-flowering-bulbs-trials-in-north-carolina



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In our trials in Ithaca NY, beds were rototilled to 8" deep, and a slow release bulb food (Bulb Tone, 4-10-5) was incorporated at the recommended rate. Bulbs were planted (usually in mid-October) in holes that were 1, 3, 6 or 8" deep (2, 7.5, 15 or 20 cm). After filling the holes, plots were covered with 0 or 4 inches (10 cm) of mulch for the 6 and 8" plots, and with 0, 2, 4 or 6 inches (0, 5, 10, 15 cm) of mulch for the 1" and 3" deep plots. Mulch was "double ground hardwood bark mulch", as indicated by the supplier.

Sixteen (16) bulbs were planted 5" apart in each plot. Plots were then mulched as above using 36" x 36" frames that were 2, 4 or 6" high to provide uniform mulch depth on the plots.

After plants flowered each spring, they were allowed to continue growth and flowers were allowed to wilt on the stem. Any seed pods that formed were left on the plant. Beds were held fallow over the summer. Thus, it was a minimal maintenance situation. After all stems and leaves were totally dry they were removed and weeds managed by summer and fall Round-Up (glyphosate) sprays. All water was from natural rainfall, no irrigation was used. Each fall, the mulch for each plot was re-established to the original height (2, 4 or 6"). No additional fertilizer was applied. Annually for 3 growing seasons, data were collected on growth characteristics, including height, time of bloom and most importantly, the number of flowers per plot.

In the first two years, each combination of planting depth and mulch had 2 replicate plots per cultivar. In the last 4 years, replication was increased to 5 replicate plots per treatment per cultivar each year. All told, nearly 600 plots make up the data presented in this newsletter.

What we found

In the first year of flowering, there were usually few differences in growth, other than the bulbs planted 1" deep with no mulch were nearly all dead, either from animal activity or direct freezing. Even so, unmulched bulbs in holes 1" deep, sometimes did survive the exposure of winter and flowered in year 1. By year 2, differences between treatments became more apparent. We'll now focus on plant performance in the third year, which is a good time frame for tulips to perennialize. Bear in mind that "year 3" was a different calendar year, as plots were installed in 6 different years.

For year 3 flowering, averaged over all mulch depths, the deeper tulips were planted, the worse their performance (Fig. 1). This was very unexpected and immediately suggests the standard wisdom that "deeper planting is better", or planting in 8" deep holes is incorrect.



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Fig. 1. Number of flowers per plot in the third year of flowering. Data are averaged over all mulch treatments, from plots of 16 bulbs each. This represents data from 6 separate experiments started in 6 different years.

What if we don't mulch? In general, this would be an uncommon situation as most gardeners in North America mulch their garden at some point in the season. Even so, planting depth had a big effect on how tulips performed over three years. The data show that bulbs should not be planted any deeper than 6", as deeper planting tended to reduce the number of flowers in year 3 in Negrita and had no beneficial effect for Parade (Fig. 2). Note that the number of flowers in the non-mulched plots are quite low, compared to mulched plots (see next section).



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Number of flowers from 16 bulbs in year 3, for non-mulched plots (through 2018).

If we consider plots that were all mulched to a depth of 4", we see a very strong effect of planting depth. When plots were covered with 4" of mulch, deep planting (6" or 8") is very detrimental to plant performance in the third year (Figs. 3 and 4). Given that most tulips are mulched, perhaps this information should be adopted for planting and package instructions.



Fig. 3. 2018





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Figure 4.



Effect of planting depth in year 3 for plots covered with 4" of mulch. Top: Negrita, bottom: Parade. Left to right, bulbs planted into holes that were 8", 6", 3" or 1" deep. All plots had 4" of mulch, that was renewed annually.



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Figures 5 and 6 show Negrita and Parade plots in the third year of flowering. For both, it is clear that planting bulbs into 8" deep holes, whether mulched or not, is highly detrimental to 3rd year survival and flowering. Planting into 6" deep holes is better than using 8" deep holes, but even so, much less flowering than when planted into 3" or 1" deep holes. For the two shallow depths, the greater the mulch depth, the better the performance in the third year, even to the point that a mulch depth of 6" is better than 4" dep mulch. From a practical view, 4" of mulch is sufficient, and just as people don't want to dig 8" dep holes, they probably done want to pile up 6" of mulch.





3" deep no mulch 3" deep, 2" mulch 3" deep, 4" mulch 3" deep, 6" mulch



1" deep no mulch 1" deep, 2" mulch 1" deep, 4" mulch 1" deep, 6" mulch





Fig. 5. Third year flowering of Parade (planted in 2015, photos from 2018) showing effects of mulch depth. Top panel 8" and 6" deep planting. Middle panel, 3" deep planting and bottom panel, 1" deep planting.



8" deep, no mulch 8" deep, 4" mulch 6" deep no mulch 6" deep, 4" mulch



3" deep no mulch 3" deep, 2" mulch 3" deep, 4" mulch 3" deep, 6" mulch



1" deep no mulch 1" deep, 2" mulch 1" deep, 4" mulch 1" deep, 6" mulch Fig. 6. Third year flowering of Negrita (planted in 2014, photos from 2017) showing effects of mulch depth. Top panel 8" and 6" deep planting. Middle panel, 3" deep planting and bottom panel, 1" deep planting.



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The result of this work is clear. Planting into deep holes, as presently recommended on many dry sale packages, is detrimental to tulip perennializing. In fact, even in an annual planting system, deep planting would have no benefit, as all planting depths performed well in the first flowering season.

We can wonder why we saw these results. Perhaps the mulch, as it decomposed, provided some nutrition to the bulbs. It is well known that fertilization is beneficial to bulb perennializing. It is also possible that planting deeper in the soil profile exposed the bulbs to wetter soil conditions throughout the year which can be presumed to be detrimental to the bulbs. The soil in this experiment is a clay loam and while reasonably well-drained, shallower planting would obviously be a better drained environment which should be beneficial.

It should also be remembered this work was done in USDA climate zone 5b (which is cold!). Perhaps different results would be found in different zones, but this work was inspired by trials Gus De Hertogh did in North Carolina (zone 7) so even in warmer climates, this method should work well. what is especially interesting is that we saw no evidence of injury from ground freezing over the three years. Certainly, there were times when leaf tips were frozen after emergence, from late cold snaps and this happened in all plots (not related to planting treatment). But even shallow-planted bulbs did not freeze and performed well when covered with 2 or 4" of mulch.

To summarize, it is clear that shallow planting with added mulch, is a good way to go and is physically much easier than deep planting as we currently recommend.

Here's what customers can do for large scale plantings.

- Till the area 3-4" deep with a rototiller. If possible, spread recommended bulb fertilizer and incorporate this by tilling.
- With a small garden spade, pull back soil in a single motion, 2-3" deep, and immediately place the bub. This is similar to "Keukenhof planting". When done, gently rake the area to smooth out the surface.
- Cover with 2-4 inches of aged mulch or well-rotted compost.

For smaller scale plantings, or if a rototiller is not available, use a shovel to prepare holes to a depth of 3 inches, place the bulbs, cover, and then mulch with 2-4" of mulch.