Cornell University
Cooperative Extension
Northwest New York Dairy, Livestock & Field Crops Team

Varying Corn & Soybean Populations, Varieties, & Down Force

By Bill Verbeten, Regional Agronomist, Cornell Cooperative Extension

There are many opportunities to save money on seed costs, increase profits, and increase yields by varying corn and soybean seeding rates, varieties, and down force pressure within the same field in NY. Corn and soybean yields are greatly influenced by decisions made at planting and with lower prices likely in 2015 cash-grain farmers can't afford to leave yield on the table out of the gate.

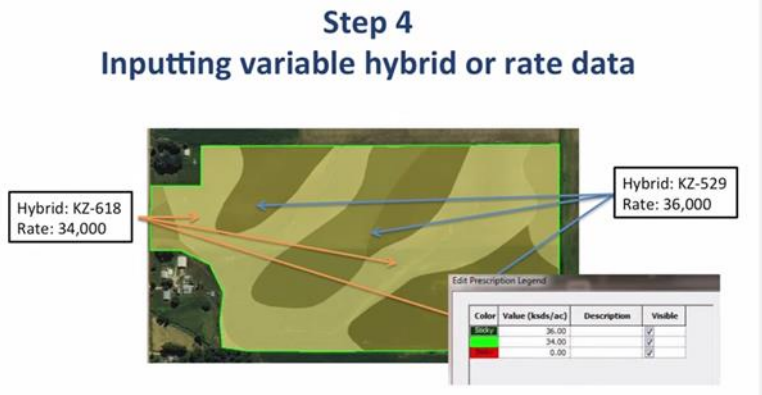
Varying Seeding Rates

Some areas of corn & soybean fields simply never yield very much--the headlands are often compacted, field edges near woodlots or hedgerows are covered in shade, and some low spots are always wet. Even without variable seeding rate technology farmers can reduce seed costs by cutting populations back moderately (4,000 to 7,000 kernels/acre). During the 2012 drought researchers in Indiana found optimal corn plant population was ~7,000 plants per acre lower on unirrigated soils, http://www.agry.purdue.edu/ext/corn/news/timeless/seedingrateguidelines.html. In the longer term it may be worth planting these unproductive areas to a grass to keep weeds down and allow for easy access for field operations.

For farmers with precision ag equipment varying planting prescriptions can be written before the planting season even begins. In addition to lowering corn populations in headlands, fields edges, and wet spots farmers can vary their corn seeding rates based on management zones created from multiple years of yield mapping or soil fertility levels, *Figure 1.*

The most common approach is to plant lower corn seeding rates in lower yielding areas and increasing seeding rates to higher yielding areas. Differences in soil types, soil tests, aerial imagery, and farmer experience often used as well to make these management zones. However there are some areas of many fields that do not consistently yield high or low---they often vary with rainfall from year-to-year. The differences in variable corn seeding rates are generally moderate (2,000 to 5,000 seeds per acre). The Cornell Field Crops Guide recommends planting ~ 28,000 seeds per acre (90% emergence) on droughty soils and up to ~32,000 seeds per acre on deep, loamy soils for corn grain fields. For fields that have these different soil types varying corn populations will have a higher chance of response then a field with more similar soil types. At the end of the day yield increases are possible, but not guaranteed from varying corn seeding rates as some recent work from Indiana has shown, http://www.agry.purdue.edu/ext/corn/news/timeless/seedingrateguidelines.html. The NYCSGA is currently evaluating varying corn populations on many farms locally and are looking for more farmers to participate in these trials.

Figure 1: Writing a Variable Planting Prescription



Source: Kinze YouTube channel.

Farmers varying soybean seeding rates should take the opposite approach according to the experience of some agronomists in Ontario, Canada. High yielding areas for soybeans are often better soil with higher moisture levels. In order to decrease the chances of white mold outbreaks, soybean populations should be lowered in high yielding areas to increase air movement in the field. In 2014 many of the higher soybean seeding rates treatments in the NYCSGA population trial that were planted in higher moisture, high yielding areas had devastating outbreaks of white mold.

Cornell University
Cooperative Extension
Northwest New York Dairy, Livestock & Field Crops Team

Varying Corn & Soybean Populations, Varieties, & Down Force

By Bill Verbeten, Regional Agronomist, Cornell Cooperative Extension

These infected areas often show up as lower yielding areas on yield maps, even though they are probably on more productive ground. This is why having good farmer/agronomist knowledge of the field and scouting records are critical to properly determining management zones. Truly lower yielding areas (often drier, lighter soils) may require higher seeding rates of soybeans to get adequate populations. Differences in variable soybean seeding rate prescriptions may need to be greater than corn in order to see a response in yield because soybeans change their growth patterns to compensate for differences in plant populations, row spacing, and variety type. Soybeans planted at lower populations or wider rows tend to grow more branches compared to soybeans planted in narrower rows or at higher populations. Bush or erect type soybeans may respond differently in 15 to 30-inch rows to moderate or high seeding rates, but in 7.5-inch rows or very low populations (50,000 plants/acre) yields do not differ between these two types of soybeans, https://www.extension.purdue.edu/extmedia/ay/ay-217-w.pdf.

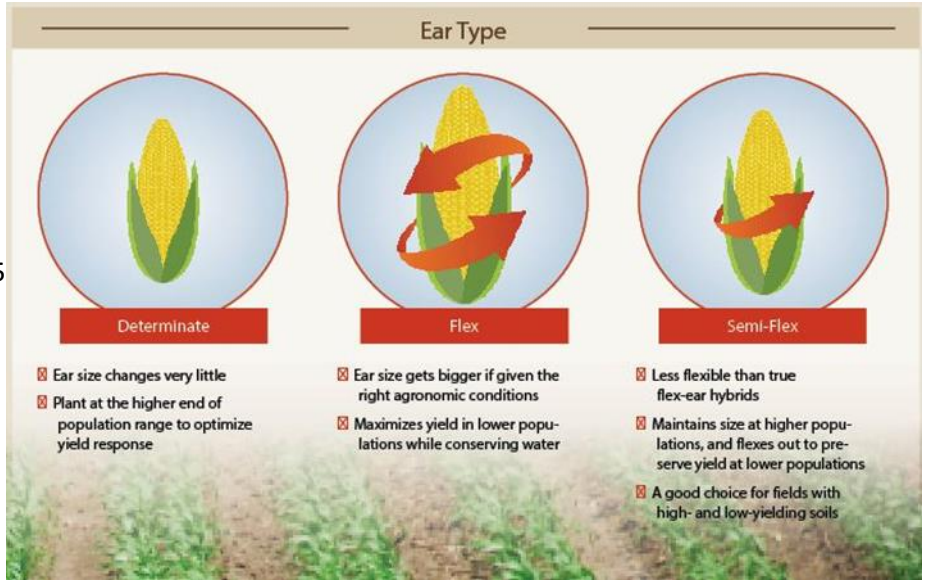
Planting with a drill also makes accurately varying soybean populations a challenge, compared to a corn planter. The current Cornell recommendations are to plant soybeans in 7.5-inch rows at 170,000 seeds per acre, 15-inch rows at 160,000 seeds per acre, and 30-inch rows at 150,000 seeds per acre. Again the yield response based on varying planting populations alone appears to be a mixed bag, unless varieties are also varied along with population.

Varying Varieties

Most farmers are already varying their corn and soybean varieties across their whole farm. Longer day/later relative maturity varieties are often planted first, with shorter season varieties planted towards the end of planting season. Some fields require corn and soybean varieties with disease resistance, especially those in lower fields down in river valleys.

New equipment is allowing multiple varieties to be easily planted in the same field. Kinze's multi-hybrid planter, http://www.kinze.com/planter.aspx?id=17&4900+Multi-Hybrid+Front+Fold+Planters, leads the way with the capability to switch seamlessly between two varieties, often an "offensive" one in the high yielding areas a "defensive" hybrid in the low yielding areas, within the same row across the entire field. Results from trials conducted by Beck's hybrids in the Midwest are promising with gains of 4.5 bu/acre with offensive varieties seeded at higher rates and 9.4 bu/acre with defensive varieties seeded at lower rates in corn fields which resulted in a ~$50/acre profit. They also found 3.7 bu/acre gains with a defensive soybean variety and 2.8 bu/acre gains with an offensive variety for an increase profit of ~$40/acre, http://www.agriculture.com/crops/corn/technology/how-splitting-hybrids-varieties-

Figure 2: Corn Ear Types



Source: AgWeb

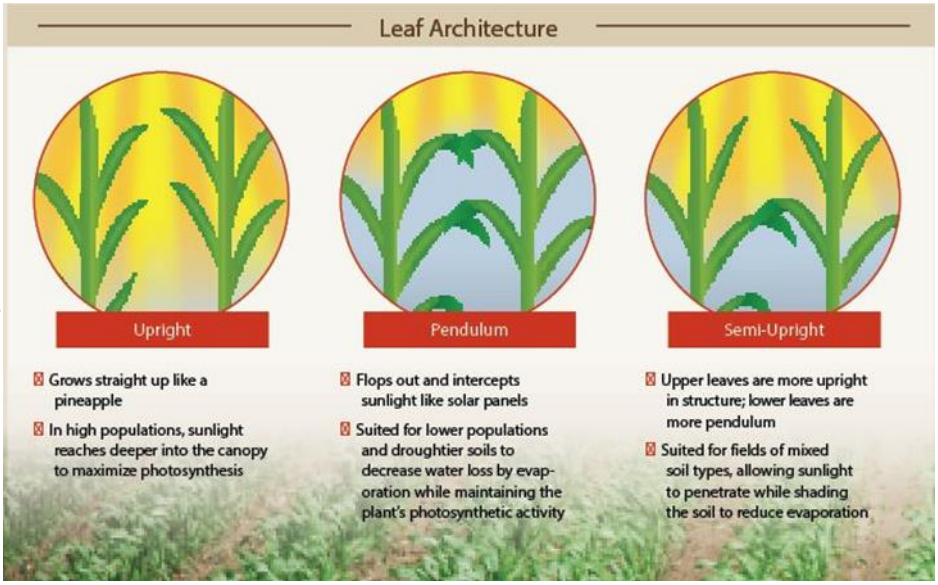
Cornell University
Cooperative Extension
Northwest New York Dairy, Livestock & Field Crops Team

Varying Corn & Soybean Populations, Varieties, & Down Force

By Bill Verbeten, Regional Agronomist, Cornell Cooperative Extension

c-make_139-ar42138?print. In 2013 in South Dakota, researchers found increases of 5.1 bu/acre in corn and 3.4 bu/acre in soybean by varying varieties within the same field, http://www.agweb.com/article/a_boost_in_bushels_NAA_Nate_Birt/.

Figure 3: Corn Leaf Architecture



Source: AgWeb

What are "offensive" & "defensive" corn hybrids? Typically offensive hybrids have upright leaves and determinate ears to try to allow the most light to reach the plants and maximize yields (often in narrow rows) and are planted at higher populations. In contrast defensive hybrids have pendulum leaves (which cover the soil) and flex ears to protect yields against droughty conditions and are planted at lower populations. Defensive hybrids may also have more disease resistance than offensive varieties. Many farmers currently plant corn with semi-upright leaves with semi-flex ears to hedge their best across highly variable soil conditions. Newer planters will allow NY farmers to take advantage of the variations in their fields in the years to come. See *Figures 2 & 3* for descriptions of these characteristics. In the late 1990's work at Cornell University did not show a benefit to varying corn hybrids across a field. That work found that managing the year-to-year variations due to rainfall were more important than the spatial variations in the field, which eventually lead to the development of Adapt-N, http://nwnyteam.cce.cornell.edu/submission.php?id=347&crumb=precisionxxag|15. Combining this nitrogen availability model that measures variations across time with management zones that vary in space across fields is something the some NY farmers are currently experimenting with in improve their precision management. Current evaluations are also underway to calibrate variable nitrogen applications to corn based on NDVI measurements from the ground and the air in NY. While no current work in NY is exploring the interactions of variable nitrogen rates in combination with variable corn populations it will likely be a part of future on-farm experiments.

The NY Corn and Soybean Growers Association is currently in their third year of evaluating varying corn and soybean population rates. Any farmer interested in participating should contact Savanna Crossman at savannacrossman@hotmail.com or 802-393-0709.

Cornell University
Cooperative Extension
Northwest New York Dairy, Livestock & Field Crops Team

Varying Corn & Soybean Populations, Varieties, & Down Force

By Bill Verbeten, Regional Agronomist, Cornell Cooperative Extension

Varying Down Force

Soil moisture conditions can vary widely from within a field and between fields during planting. The days are long and getting off the tractor to make the manual adjustments (higher pressure in dry conditions & lower in wet conditions) to the planter ensure a constant planting depth without side-wall compaction is not practical. Using variable rate down force pressure can ensure constant ground contact and ultimately increase yields, *Table 1.* Additionally using a hydraulic system responds much faster (~1 second) compared to an air bag system (up to ~20 seconds) and yield will be left on the table if down force doesn't quickly respond to changes in soil moisture conditions.

Table 1: Corn Yield Response to Variable or Fixed Rate Down Force Pressure

Down Force	Down Force Pressure Setting	Corn Yield (bu/acre)	Years Tested
DeltaForce Variable Rate	Standard Setting	**+9.4**	2013-2014
DeltaForce	0 lb. Manual	**-16.3**	2013-2014
DeltaForce	125 lb. Manual	**-8.4**	2013-2014
DeltaForce	250 lb. Manual	**-5.8**	2013-2014
DeltaForce	375 lb. Manual	**-7.1**	2013-2014
AirForce Variable Rate	Standard Setting	**+7.8**	2009-2014
T-Spring	0 lb. Manual	**-11.2**	2009-2014
T-Spring	125 lb. Manual	**-4.4**	2009-2014
T-Spring	250 lb. Manual	**-5.9**	2009-2014
T-Spring	375 lb. Manual	**-9.5**	2009-2014

Source: Beck's Hybrid PFR Summary 2014