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Insects, Mites, and Nematodes

Soybean Aphid Throughout Most of Indiana –
(John Obermeyer and Larry Bledsoe) –

- Soybean aphid numbers highest in northern Indiana
- Reports of significant numbers in southern counties
- Make treatment decisions on aphid numbers and plant growth stage

Soybean aphid populations vary greatly not only in areas of the state, but locations in the field as well. Most calls concerning threatening populations have come from the northern counties. Recently, pest managers in central counties have begun calling with questions about aphids and control. Some significant populations have been reported as far south as Columbus (Bartholomew County).

Lots of questions and few well researched answers have led to confusion on treatment guidelines. The following are our control recommendations based on current understanding of the pest the Midwest:

- Treat R2 to R3 soybean (see growth stages below) if there are hundreds of aphids per plant. Aphid feeding can cause pod abortion during this time.

- Treat R4 soybean when there are greater than 1,000 aphids per plant. At this level of infestation, aphids will be not only be on leaves, but stems and pods as well.
- Don't treat R5 or greater soybean unless there are thousands of aphids per plant. Most areas of Indiana have ample ground moisture to fill pods. Thousands of aphids per plant may prevent good pod fill. Areas under moisture stress should lower this threshold.
- Re-evaluate fields in few days if diseased aphids are being found. Don't confuse diseased aphids with cast aphid skins.
- Leave an untreated check strip in treated fields. This check should be weighed separately at harvest for yield comparisons.
- Use ground driven applicators with at least 20 gallons of water per acre and at least 40 p.s.i.
- Treating fields near the end of August, no matter the soybean growth stage, is not advised.

We are aware of at least one chemical company aggressively marketing their product in areas where aphid numbers are low with boasts of yield guarantees. Don't be swayed by these fear factor attempts. Don't treat just because a neighbor is treating. Instead, scout your fields and make rational, informed decisions.

Soybean growth stages:

- R2 – (Full Bloom) Open flower at one of the two uppermost nodes on the main stem.
- R3 – (Beginning Pod) Pod is 3/16" long at one of the four uppermost nodes on the main stem.
- R4 – (Full Pod) Pod is 3/4" long at one of the four uppermost nodes on the main stem.
- R5 – (Seed Fill) Seed is 1/8" long in the pod at one of the four uppermost nodes on the main stem



Soybean Growth Stages (left to right) R3, R4, and R5



Underside of leaflet with aphids and cast skins



Cast skins (exoskeleton) of the aphids on a leaf



Close-up of aphid cast skins, "dandruff"



Early sign of aphid disease, note darker aphids



Close-up of a healthy and two diseased aphids



Aphids that have been killed by disease. Diseases can spread quickly through an aphid population.

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Harvest Restrictions for Soybean Aphid Insecticides - (John Obermeyer and Larry Bledsoe) -

The following listing includes insecticides registered for soybean aphid control, including rate per acre and harvest restrictions. Refer to the label for specific rates and application information.

Soybean Insecticides and Harvest Restrictions		
Product	Rate and Formulation	Days Before Harvest
chlorpyrifos (Lorsban)*	2 pt 4E	28
lambda-cyhalothrin (Warrior)*	1.9 - 3.2 oz 1CS	45
methyl parathion (PennCap-M)*	3 pt 2FM	20
zeta-cypermethrin (MustangMax)*	3.0 – 4.3 oz. 0.8EW	21
* Restricted Use Pesticide		

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Black Light Trap Catch Report - (John Obermeyer)

County/Cooperator	7/29/03 - 8/4/03							8/05/03 - 8/11/03						
	VC	BCW	ECB	SWCB	CEW	FAW	AW	VC	BCW	ECB	SWCB	CEW	FAW	AW
Dubois/SIPAC	0	6	1	1	1	0	9	0	8	0	0	1	0	2
Jennings/SEPAC	1	5	2	0	0	0	2	0	5	2	0	0	0	10
Knox/SWPAC	1	1	1	0	0	0	2	0	1	3	2	1	0	2
LaPorte/Pinney Ag Center	0	0	26	0	0	0	5	0	0	61	0	0	1	2
Lawrence/Feldun Ag Center	0	0	2	0	0	2	12	0	9	7	1	0	0	4
Randolph/Davis Ag Center	0	1	24	0	0	0	10	1	0	80	0	0	0	6
Tippecanoe/TPAC Ag Center								1	0	44	0	1	0	3
Vermillion/Hutson			51							55				
Whitley/NEPAC	6	0	48	0	0	1	10	1	0	125	0	0	0	5

VC = Variegated Cutworm, BCW = Black Cutworm, ECB = European Corn Borer, SWCB = Southwestern Corn Borer, CEW = Corn Earworm, FAW = Fall Armyworm, AW = Armyworm

Agronomy Tips

Stalk Health Issues in Stressed Corn - (Bob Nielsen)

Even though the current USDA corn production estimate for Indiana is remarkably optimistic (<http://www.nass.usda.gov/in/pressrel/de081203.txt>), many growers recognize that individual fields or areas within fields have been struggling against multiple stresses throughout the season. Problems resulting from stress in 2003 include root damage and lower leaf death due to soggy soils, leaf canopy yellowing and death due to nitrogen deficiency resulting from soggy soils, stunted root and canopy development due to excessively dry soil moisture conditions, limited crop canopy photosynthesis due to frequent cloudy or hazy days, and root damage from corn rootworm larva feeding.

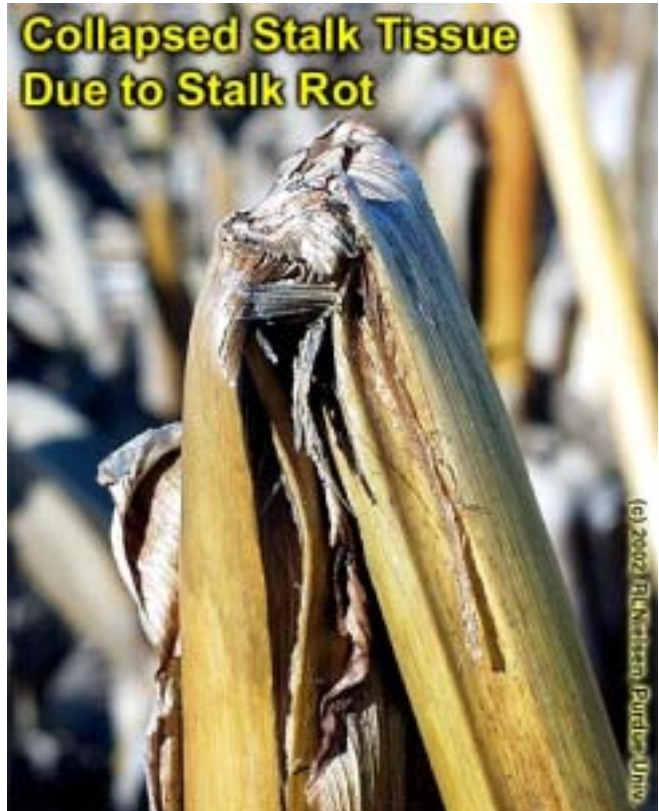
Fields or areas within fields that have suffered one or more of these stresses will be stressed further during the grain filling period as the photosynthetic factory tries to keep up with the physiological demands of the developing ears. In some severe situations, plants that are unable to keep up with the demand, due to less than healthy root systems or crop canopies, will resort to cannibalizing stored carbohydrate reserves in the lower stalk tissue and remobilizing those reserves to the developing ears.

Such remobilization of stored carbohydrates from lower stalk tissue causes an overall deterioration of lower stalk integrity and strength. More importantly, as carbohydrate concentrations decrease in the lower stalk or root tissues, their resistance to the soil complex of root- and stalk-rotting organisms also decreases.

Beginning in late August or early September, growers should begin regular inspections of suspect fields that have endured multiple stresses this year and monitor the general health of the lower stalk and roots of plants. Stalk health in such fields further stressed by excessively dry soil conditions during grain filling will be particularly suspect.

The simplest diagnostic technique is to push stalks away from you as you walk down rows of corn and see whether they collapse and break or “spring back” to a vertical position. Easily broken plants signal either significant cannibalization of lower stalk tissue or development of stalk rot. In either case, such fields are prime candidates for stalk lodging concerns prior to harvest.

Pinching lower stalk internodes between your fingers can identify lesser degrees of stalk health concerns. If the internodes “give way” or collapse easily, that is also a signal that stalk health has been



compromised. Split such stalks in half and inspect the interior for obvious disease symptoms.

Root health can be monitored first by attempting to pull plants out of the soil with your hands. If this can be done easily, chances are that root health has been compromised and the field is at risk of root lodging if severe windstorms occur prior to harvest. If plants do not pull easily, then dig a few plants, wash the soil away from the root system, and inspect the roots for discoloration (red, purple, brown) that could indicate early root rot development.



If fields are identified that are clearly high risk for root or stalk lodging prior to harvest, then schedule these fields for earlier than anticipated harvest to minimize the risk and consequences of severe lodging relative to potential mechanical harvest losses.

Related References:

Shaner, G. and D. Scott. 1998. **Stalk Rots of Corn** (BP-59). Purdue Univ. Coop. Extension Service, W. Lafayette, IN. Available online at <<http://www.agcom.purdue.edu/AgCom/Pubs/BP/BP-59.pm65.pdf>>. [URL verified 8/13/03].

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Munkvold, G. 1996. **Corn Stalk Rot in Iowa** (IPM-50). Iowa State Univ. Coop. Extension Service, Ames, IA. Available online at <http://www.ag.iastate.edu/departments/plantpath/extension/corn_stalk_rot.pdf>. [URL verified 8/13/03].

Stack, J. 1999. **Common Stalk Rot Diseases of Corn** (G99-1385-A). Univ. of Nebraska Coop. Extension Service, Lincoln, NE. Available online at <<http://ianrsearch.unl.edu/pubs/plantdisease/g1385.htm>>. [URL verified 8/13/03].

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Blunt Ear Syndrome in Corn - (Bob Nielsen) -

Blunt Ear Syndrome (BES) in corn, sometimes also referred to as "Beer Can Ear" Syndrome, is a curious oddity that occurs from time to time throughout the corn growing areas of the U.S. The major symptom of BES, unusually short ears, is the consequence of arrested ear development that likely occurs during the ear size determination period prior to pollination. Researchers at Colorado State University have devoted the most energy to investigating this problem, but the causes of the arrested ear development have not been conclusively identified (Pearson, 1998; Pearson & Brown, 1999; Pearson, 2000).

Symptom Details

Interestingly, the symptoms of BES appear to be restricted primarily to the development the ear. Other aspects of plant appearance (stalks, leaves, husks) are

normal in every respect until later in the season when plants with severely arrested ears turn shades of red and purple in response to an overabundance of plant sugars in the leaf and stalk tissues.

The cob of a "beer can" ear is remarkably short and the tip inch or so is often barren. Interestingly, kernel row number at the butt end of these ears appears to be reasonably normal. Part way up the ear, however, cob and kernel row development simply cease. Compared to a fairly typical 35 to 40 kernels per row, BES ears exhibit about half that length in terms of ovule number per row and often only 12 to 16 developed kernels per row. Silk balling, that occurs when the final silks do not successfully elongate through the remainder of the normal length husk leaves, causes the lack of kernels at the tips of BES cobs. More severe forms of BES occur from time to time, leaving one with what looks like a corny hand grenade.



The tip of a BES cob sometimes exhibits a tassel branch-like appendage, while other ears exhibit an apparent remnant ear initial similar to that visible by

dissection of ear shoots at about leaf stage V9 (nine visible leaf collars). The latter symptom suggests that development of the ear initial was interrupted or arrested between the time ear initiation occurred (about V5) and kernel row number was finalized (about V12). The half-length size of the cobs suggests that ear development was stopped at approximately leaf stages V8 to V9.



Possible Causes of BES

Because ear development is arrested or stopped completely and suddenly (normal row numbers, then nothing), the cause of the problem would appear to be a single triggering event, not a lingering stress like nutrient deficiency or soil pH. One possible cause of BES could be the application of certain post-emergence herbicides (growth regulators or ALS-type) during the period of row number determination (V5 – V12). While possible, this cause can be ruled out because of the diversity of herbicide programs encountered in documented cases of BES.

Another possible cause of such a dramatic termination of ear development is chilling injury. Indeed, research reported from Belgium (Bechoux et al., 2000; Lejeune and Bernier, 1996) documented that chilling injury at the time of ear and tassel initiation (about V5) could prevent ear initiation altogether or reduce tassel branch and spikelet formation. Perhaps chilling injury to the developing ear at somewhat later leaf stages could similarly arrest further ear development?

The term “chilling injury” does not necessarily translate simply to frost events. Temperatures in the high 40’s to low 50’s may be sufficient to injure meristematic regions of the corn plant, especially if temperatures during the days preceding the chilling injury were warm to excessively warm.

Why the Interest in BES in 2003?

The purpose of this article is two-fold. First of all, I’ve received three reports of suspected BES occurrences

in recent weeks; one from Michigan (dent corn), one from Ohio (dent corn), and one from Nebraska (popcorn). If true, it suggests that this may be one of those years conducive to the development of BES. The existence of BES is not evident from the road unless or until severely affected (nearly barren) plants turn bright red or purple later in August or early September.

Secondly, a new Ph.D. student working with me has begun a research project to investigate the possible link of chilling injury with the development of BES symptoms in corn. Briefly, the project involves the use of controlled environment growth chambers to “cold shock” young corn plants at several selected pre-pollination leaf stages. The plants will subsequently be evaluated for evidence of arrested ear development. Needless to say, this student is also very much interested in documenting background information about “real world” occurrences of this phenomenon if they arise this year.

Toward that end, we would appreciate hearing about any instances of BES that are discovered this growing season. If our calendars permit, we would love to visit fields where BES is reported in order to document the background information associated with the field and cultural practices. If we cannot visit the field(s) ourselves, we would appreciate anyone who identifies fields with BES symptoms to send us digital images and/or complete a brief field information form that is downloadable at <http://www.kingcorn.org/research/beercan/FieldInfoform.pdf>.

Related References:

Bechoux, N., G. Bernier, and P. Lejeune. 2000. **Environmental effects on the early stages of tassel morphogenesis in maize (*Zea mays* L.)**. *Plant, Cell & Environment*. 23(1):91-98.

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Pearson, Calvin. 1998. **Evaluation of Golden Harvest Corn Hybrids for Blunt Ear Syndrome.** Western Colorado Research Center 1998 Annual Report. Colorado State Univ., Fruita, CO. Available online at <<http://www.colostate.edu/programs/wcrc/annrpt/98/bluntear.pdf>>. [URL verified 8/12/03].

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Pearson, Calvin. 2000. **How Blunt Ear Syndrome of Corn is Affected by Hybrid and Irrigation at Fruita, Colorado 2000.** Western Colorado Research Center 2000 Annual Report. Colorado State Univ., Fruita, CO. Available online at <http://www.colostate.edu/programs/wcrc/annrpt/00/Pearson_BluntEarSyndrome.html>. [URL verified 8/12/03].

Don't forget, this and other timely information about corn can be viewed at the Chat 'n Chew Café on the Web at <<http://www.kingcorn.org/cafe>>. For other information about corn, take a look at the Corn Growers' Guidebook on the Web at <<http://www.kingcorn.org>>.

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Corn Yield Trends for Indiana 1930 - 2003 - (Bob Nielsen) -

Historical grain yields provide us with a glimpse of yields yet to come, although like the stock markets, past performance is no guarantee of the future. State average corn grain yield in Indiana has increased at a fairly constant 1.6 bushels per acre per year since 1930 primarily due to improved genetics and production technology (Fig. 1).

Since 1990, Indiana's corn crop yield has split even, with half of those years below trend and half above. The [current USDA estimate for 2003](#) puts the Indiana corn crop at 144 bushels per acre, or about 1.7 percent **above** the 2003 trend line yield of 141.6 bushels per acre (Fig 1). By comparison, recent years' departures from trend yield (Fig. 2) were 2002 (-13.6 %), 2001 (+12.7 %), 2000 (+7.5 %) and 1999 (-2.4 %). August corn production estimates for each crop reporting district in Indiana are available in [text](#) or [graphical](#) formats.

Figure 1.

Figure 2.

Annual grain yield values fluctuate above and below the trend line throughout the more than 70 year period of records, but four disaster years are especially noteworthy. Late planting plus early fall frosts in 1974 resulted in state average corn yields 25% less than the trend value. Severe droughts in 1983, 1988 and 1991 resulted in yields 33%, 29% and 25% less than trend values.

Because the departures from trend for these four years are so dramatic, it is of some interest to calculate the trend line for corn grain yield without their inclusion. In so doing, the annual rate of yield increase is slightly greater (1.67 versus 1.6 bu/ac/yr) and the estimated trend yield for 2003 changes from 141.6 to 148.0 bushels per acre (Fig. 3). Such values may be more true estimates of statewide yield potential in "normal" years.



Figure 5.

Figure 3.

The top five U.S. corn grain producing states are Iowa, Illinois, Nebraska, Indiana and Minnesota (Fig. 4). As of the [January 2003 final production estimates](#), these five states (6.08 million bushels) accounted for nearly 68 % of the total estimated grain yield for the U.S. in 2002 (9.01 million bushels).

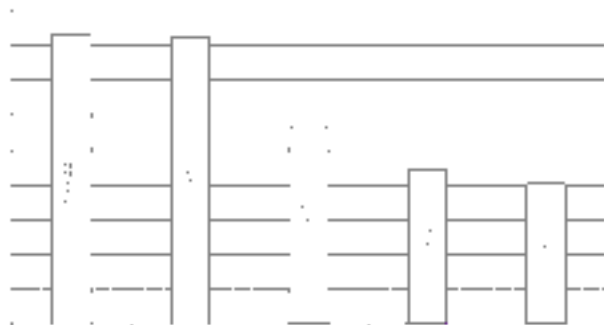


Figure 4.

Interestingly, the trophy for top statewide yields per acre does not belong to any of these Midwestern states. Bragging rights for highest U.S. corn yields per acre belong to states farther to the west (Fig. 5). A few reasons for this include a) fewer cloudy and hazy days, b) less rainfall and humidity contributing to less disease, c) availability of irrigation, and d) fewer stressful hot nights during grainfill.

For More Information...

For more statistics about Indiana agricultural production, “surf” on over to the home page of the Indiana Agricultural Statistics Service at <http://www.nass.usda.gov/in/>.

For more statistics on U.S. national crop production estimates, look at the [National Agricultural Statistics Service Crop Production](#) page on the Web.

This article is updated monthly and can be viewed at this same web address <http://www.kingcorn.org/news/articles.03/CornYldTrend2003.html>.

Weather Update

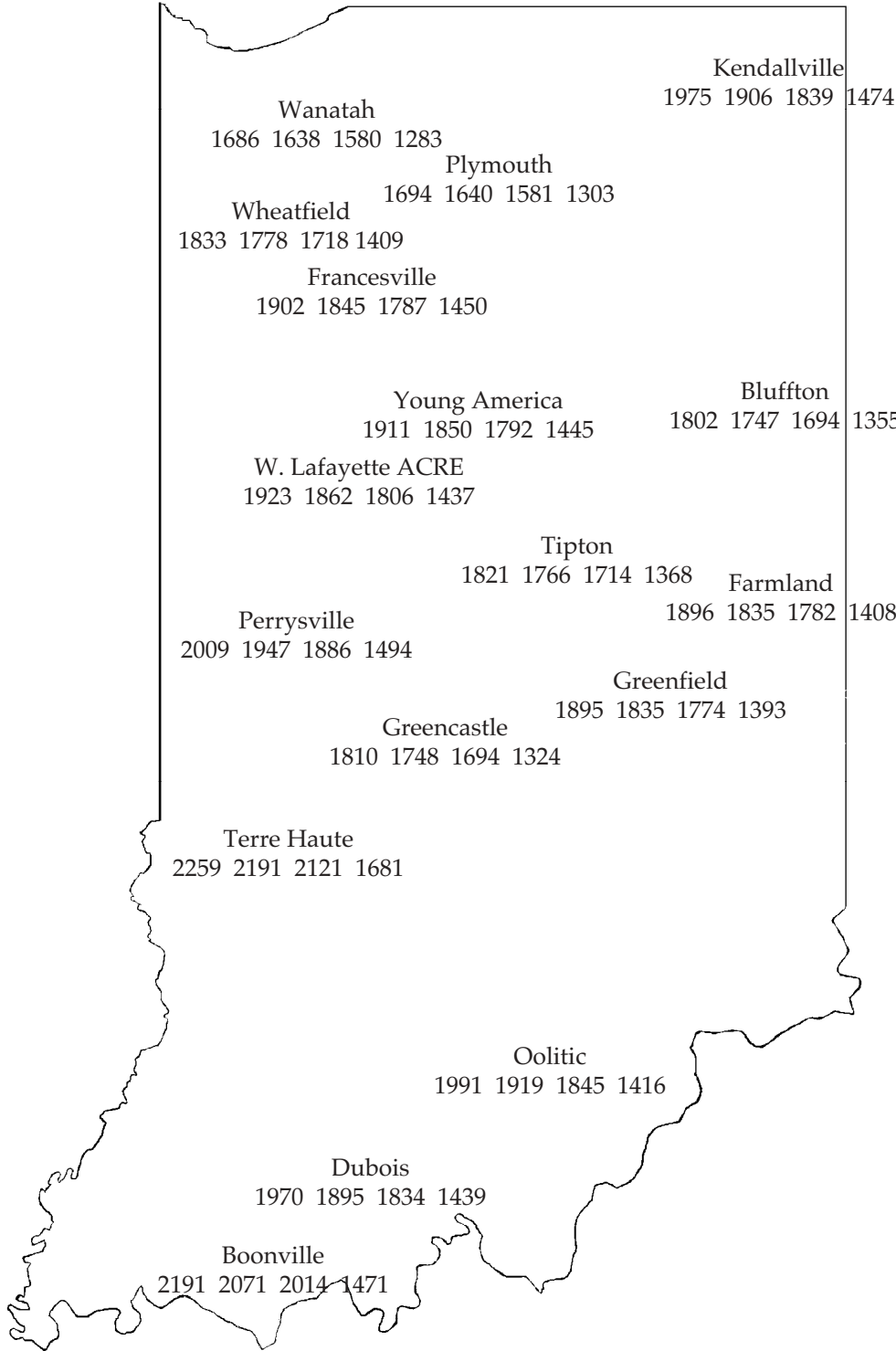
Temperatures as of August 13, 2003

GDD(9) = Growing Degree Days from April 16 (9% of Indiana's corn planted), for corn growth and development
 GDD(26) = Growing Degree Days from April 25 (26% of Indiana's corn planted), for corn growth and development
 GDD(50) = Growing Degree Days from April 30 (50% of Indiana's corn planted), for corn growth and development
 GDD(85) = Growing Degree Days from June 4 (85% of Indiana's corn planted), for corn growth and development

MAP KEY			
Location			
GDD(9)	GDD(26)	GDD(50)	GDD(85)

4" Bare Soil Temperatures 6/13/03

Location	Max.	Min.
Wanatah	81	70
Columbia City	80	70
Winamac	76	70
Bluffton	73	72
W Laf Agro	85	72
Tipton	82	73
Farmland	75	66
Perrysville	74	70
Liberty	80	69
Terre Haute	81	70
Vincennes	80	68
Oolitic	80	68
Dubois	80	70



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