NC Interagency Nutrient Management Committee **March 13, 2014**

Attendees: David Crouse, Keith Larick, Josh Spencer, Joseph Hudyncia, Colleen Hudak-Wise, Natalie Woolard, Deanna Osmond, David Hardy, Jot Smyth, Christine Lawson, Ron Gehl, Same Brake, Teague Hamblin, Jeff Klingenberg, Matt Harrod, Luciano Gatiboni, Sandy Stewart, Wesley Dunn

November 13th meeting minutes approved.

NM Software Update

N. Woolard reported that the NCDA IT staff has accepted the task of finalizing the NM Software. There is an estimated timeline that would result in beta testing in late summer and final rollout in the fall of this year. Currently, N. Woolard and J. Hudyncia are meeting with IT staff weekly to discuss status of project and work through questions that may arise. Natalie invited all members to be a part of this process as their time allows.

Corn RYE Data

As a follow up from the November meeting there was a question within NCSU Department of Soil Science whether to use the linear plateau model or a quadratic plateau model. D. Osmond reported that they would continue to support the data results from the linear plateau model.

Discussion continued on the recommended RYE for the coastal and piedmont soils. This resulted in changing previous preliminary recommendations from November 2013 meeting.

November 2013	**March 2014**
Coastal Plain Increase Yield 18%; Decrease N Factor 18%	Coastal Plain Increase Yield 20%; N Rate remains the same Back calculate N Factor accordingly for each soil type
Piedmont Increase Yield 18%; Decrease N Factor 18%	Piedmont Increase Yield 20%; N Rate remains the same Back calculate N Factor accordingly for each soil type

The data utilized in the below table is from field experiments conducted by NCSU and summarized in the attached RYE N Comparison Tables document. The calculation to determine the amount of increase follows:

	Mean of Current RYE	Mean of Field Experiment Measurements	Percent Increase of Yield
Coastal Plain	134	157	17%
Piedmont	120	146	22%

The average percentage across both regions is a 20% increase in yield. For the Piedmont and Coastal Plain, the data supports the general trend from industry of 1% increase in yield per year.

J. Smyth presented additional explanation for the recommended RYE's on corn. He discussed the need to consider optimal yield, N applications and their relationship with unused N. The attached handout on Yield Response to N in North Carolina was used as reference.

The small number of trials and data sets in the mountain region were discussed again. R. Gehl mentioned that there may be additional field data in this region. These may not necessarily be N response field trials; however they could possibly provide additional yield information. Decisions need to be made on how to differentiate between the upland and floodplain soils in the mountain region. D. Osmond will come back to the group with more information regarding the mountain soil data.

Miscanthus and Arundo Donax Discussion

Discussion took place regarding the deadline established by Session Law 2011-198 to determine final agronomic rates by December 1, 2014. Due to the nature of field experiments, much of this data that could influence the recommended rates for the energy crops will most likely not be available by this timeframe. There was concern about the term "final" because the INMC wants to be able to consider new data as it becomes available after this date. It is interpreted that this is the final rates that will be reported to the General Assembly, but not necessarily the final and permanent rates for these energy grasses.

Discussions regarding agronomic rate verse N removal rate took place. The session law currently states that agronomic rates shall be established. If the session law changes to allow for N removal rates then other state rules and potential federal policies will need to be revisited to ensure compliance with permit conditions on animal operations. Currently, it is unknown what all the ramifications of a potential change from agronomic rates.

INMC encouraged industry to continue research and provide data to the group. It is imperative to include a zero N application treatment as a control in the field experiments. It was also discussed that data, optimal yield curves, N sequestration within the plant and luxury consumption information is very useful in making decisions for these crops. The Yield Response to N in NC handout which was previously presented for the corn RYE discussion was used as an example of the type of data needed. If more data becomes available the INMC supports revisiting current recommended rates.

INMC will revisit the rationale for rates in multiple cuts of Arundo. It was requested that the same or similar rationale be used for multiple cuts of Miscanthus. This will be considered at the upcoming May meeting.

It was requested by several of the visitors to be on the email distribution for upcoming meetings. N. Woolard will ensure this is completed for future meetings.

Next scheduled meeting is May 8, 2014

Yield Response to N in North Carolina

a. Corn

Grain yield response to 56, 112, 168 and 224 kg fertilizer N $ha^{-1}$was evaluated on 3 Ultisols in the Coastal Plain during 4 consecutive years and without any irrigation. The 6-panel figure on the next page shows grain yield for each year (symbols) and location, as well as the average yield response (lines) at each location. Maximum average yields were achieved with 168 kg N ha^{-1} at Clayton and Plymouth, and with 112 kg ha^{-1} at Kinston. Note the lower yields in 1983 at both Kinston and Plymouth; this was attributed to a prolonged dry season during the corn crop at both sites.

Panels on the right in the same figure show the quantities of N accumulated in the grain and stover for each fertilizer treatment, when averaged across the 4 crop years. The quantities of unused fertilizer N were calculated as follows for each fertilizer treatment:

Unused N = Fertilizer N applied – [(N uptake fertilizer treatment)-(N uptake of check)]

where,

N uptake = grain N + stover N.

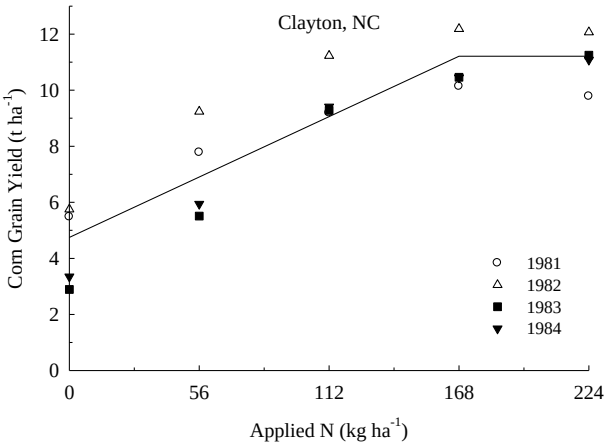
Note that the quantity of unused fertilizer N increases with N rate and can even exceed the N in grain+stover at the highest N rate (Plymouth, for example). Unused N can be minimized, but not eliminated, by avoiding fertilizer N applications that exceed the rates for optimum yield.

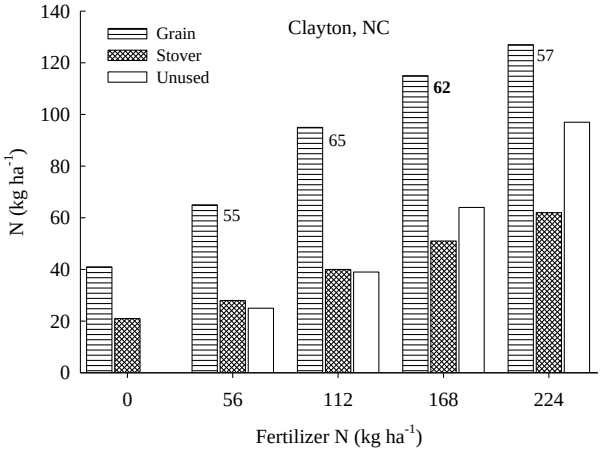
The numbers between bars for N uptake in the right panels represent the % apparent recovery of fertilizer N, calculated as follows:

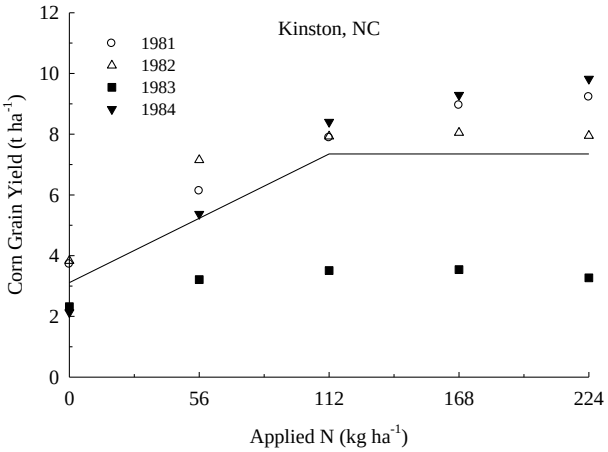
% App. Recovery = {[(N uptake fertilizer treatment)-(N uptake of check)]/(applied N)}*100

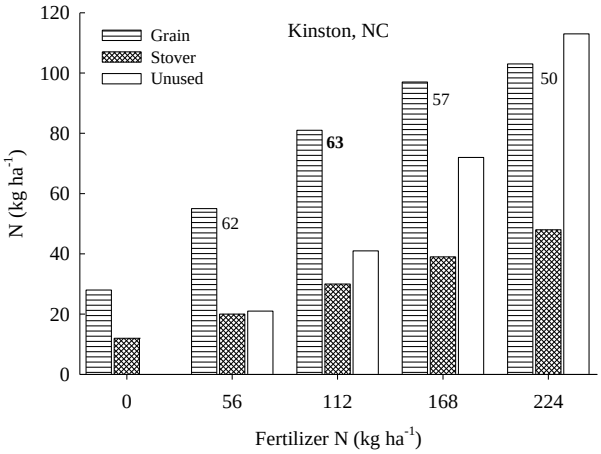
Note that apparent recovery is relatively constant within the range of linear yield response to applied N, but declines above the point where added N no longer increases yield. The literature shows that maximum apparent N recoveries for non-irrigated corn seldom exceed values of 55-60%. The quantity of unrecovered fertilizer N, and the detrimental effects on water quality, will be greatest at rates that exceed the level of yield response for each particular soil.

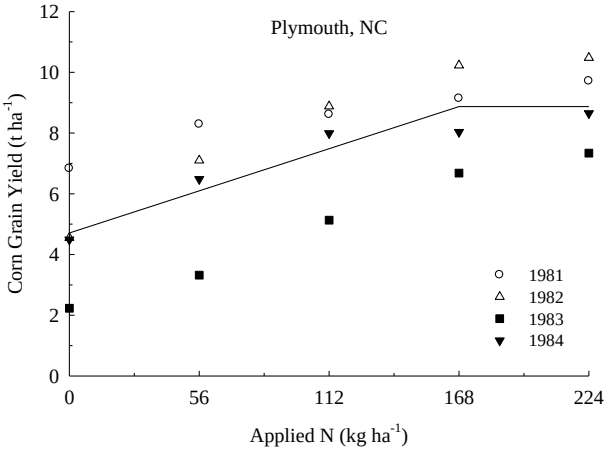
Figure Source: Kamprath, 1986

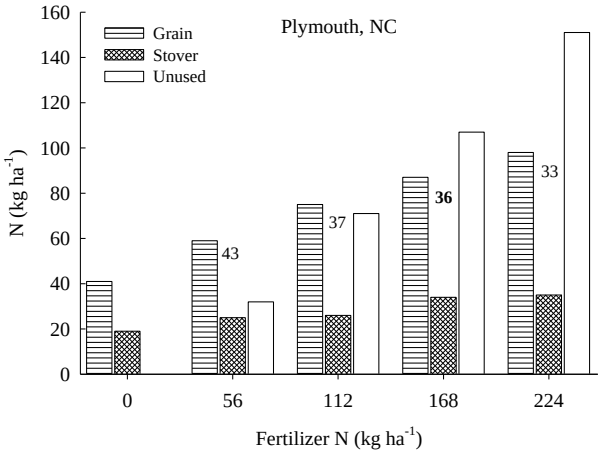

Clayton, NC
Corn Grain Yield (t ha-1)
Applied N (kg ha-1)
1981
1982
1983
1984


Clayton, NC
Grain
Stover
Unused
N (kg ha-1)
Fertilizer N (kg ha-1)
55
65
62
57


Kinston, NC
Corn Grain Yield (t ha-1)
Applied N (kg ha-1)
1981
1982
1983
1984


Kinston, NC
Grain
Stover
Unused
N (kg ha-1)
Fertilizer N (kg ha-1)
62
63
57
50


Plymouth, NC
Corn Grain Yield (t ha-1)
Applied N (kg ha-1)
1981
1982
1983
1984


Plymouth, NC
Grain
Stover
Unused
N (kg ha-1)
Fertilizer N (kg ha-1)
43
37
36
33

Soil Management Group (SMG) descriptions and mean linear-plateau N response parameters.

SMG	Description	Trials	Y Intercept	Slope
			bu/ac	bu/lb N
	Coastal Plain			
2	16-51” organic layer over sands, vpd[#]	3	94	0.46
3	16-51” organic layer over silts, loams, vpd	1	117	0.63
6	Min-org histic or umbric, fine or silty, vpd	8	76	0.38
7	Min.-org. histic or umbric, loamy, vpd	13	84	0.48
10	Mineral, silty, pd	4	81	0.48
11	Mineral, fine, pd	1	52	0.78
12	Mineral, fine loamy & coarse loamy, pd	3	91	0.51
20	Mineral, fine loamy & coarse loamy, mwd	1	84	0.69
25	Mineral, fine loamy & coarse loamy, wd	2	85	0.28
27	Arenic, 20-40” to Bt, loamy, wd to ewd	1	50	0.39
	Piedmont			
109	Rhodic, fine, wd	1	25	1.14
111	Felsic, fine, wd	1	65	0.28
113	Slate belt, fine, wd	2	82	0.38
	Mountain			
205	Flood plains, loamy, swpd to wd	3	230	0.48
206	Terrace-toe slope, fine loamy, mwd to wd	1	126	0.64
215	Terrace, argillic horizon, fine loamy, wd	1	119	0.40

[#] Drainage class: vpd- very poorly drained; pd – poorly drained; mwd – moderately well drained; wd – well drained; ewd – excessively well drained; swpd – somewhat poorly drained.

Comparisons of mean optimum yields, optimum N rates and N factors between the standard (Std.) RYE database and measured (Mea.) field experiment values for Soil Management Groups.

		Optimum Yield			Optimum N Rate			N Factor		
SMG	**N**	**Std.**	**Mea.**	**SD[1]**	**Std.[2]**	**Mea.**	**SD**	**Std.**	**Mea.[3]**	**SD**
			bu/ac			lb/ac			lb N/bu	
Coastal Plain										
2	3	130	161	29	116	120	22	1.06	0.89	0.10
3	1	150	181	--	137	81	--	1.06	0.57	--
6	8	146	150	21	139	164	47	1.06	1.21	0.28
7	13	135	162	32	135	138	36	1.11	0.97	0.28
10	4	138	167	36	124	143	39	1.06	0.99	0.12
11	1	120	183	--	130	134	--	1.08	0.73	--
12	3	130	149	57	118	96	26	1.08	0.91	0.53
20	1	130	149	--	126	75	--	1.14	0.65	--
25	2	115	128	72	105	134	48	1.14	1.34	0.34
27	1	75	114	--	70	130	--	1.22	1.33	--
Mean	*37*	*134*	*157**	*33*	*128*	*136*	*40*	*1.09*	*1.02*	*0.31*
Piedmont										
109	1	132	201	--	125	123	--	1.11	0.72	--
111	1	119	111	--	132	130	--	1.11	1.17	--
113	2	114	136	6	101	126	57	1.08	1.08	0.37
Mean	*4*	*120*	*146*	*39*	*115*	*126*	*33*	*1.10*	*1.01*	*0.29*
Mountain										
205	3	155	272	11	142	86	40	1.06	0.40	0.14
206	1	172	191	--	177	80	--	1.03	0.42	--
215	1	201	209	--	223	180	--	1.11	0.86	--
Mean	*5*	*168*	*243**	*41*	*165*	*104*	*51*	*1.06*	*0.49**	*0.23*

[1] Standard deviation of the mean for measured values in the field experiments.

[2] If the previous crop was a legume, the standard N rate was adjusted as follows: ((Std Optimum Yield x Std N factor) – legume credit); legume credit was 22 lb N/ac for soybean and 30 lb N/ac for peanut.

[3] If the previous crop was legume, the measured N factor was adjusted as follows: (Mea. Optimum N Rate + Legume Credit)/(Mea. Optimum Yield).

* Indicates the 95% confidence interval is different between the standard and measured values.

Comparisons of mean optimum yields, optimum N rates and N factors between the standard (Std.) RYE database and measured (Mea.) field values from experiments with different tillage practices.

		Optimum Yield			Optimum N Rate			N Factor		
Tillage	**N**	**Std.**	**Mea.**	**SD[1]**	**Std.[2]**	**Mea.**	**SD**	**Std.**	**Mea.[3]**	**SD**
			bu/ac			lb N/ac			lb N/bu	
Conventional	21	141	172	52	137	134	53	1.09	0.96	0.42
No-till<10 yr	18	132	152	37	125	127	28	1.08	1.00	0.27
No-till>10 yr	7	135	177*	20	127	135	37	1.08	0.86*	0.13

[1] Standard deviation of the mean for measured values in the field experiments.
[2] If the previous crop was a legume, the standard N rates was adjusted as follows: ((Std Optimum Yield x Std N factor) – legume credit); legume credit was 22 lb N/ac for soybean and 30 lb N/ac for peanut.
[3] If the previous crop was legume, the measured N factor was adjusted as follows: (Mea. Optimum N Rate + Legume Credit)/(Mea. Optimum Yield).
* Indicates the 95% confidence interval is different between the standard and measured values.

Comparisons of mean optimum yields, optimum N rates and N factors between the standard (Std.) RYE database and measured (Mea.) field values where corn was preceded by different crops.

Previous		Optimum Yield			Optimum N Rate			N Factor		
Crop	**N**	**Std.**	**Mea.**	**SD[1]**	**Std.[2]**	**Mea.**	**SD**	**Std.**	**Mea.[3]**	**SD**
			bu/ac			lb N/ac			lb N/bu	
Corn	5	132	146	23	144	167	58	1.09	1.15	0.34
Cotton	1	135	120	--	150	120	--	1.11	1.24	--
Fallow	2	186	200	13	200	130	71	1.07	0.64	0.31
Peanut	1	115	179	--	101	168	--	1.14	1.11	--
Potato	1	135	150	--	150	105	--	1.11	0.70	--
Soybean	35	135	167*	46	125	126	38	1.09	0.95*	0.34
Wheat	1	120	183	--	130	134	--	1.08	0.73	--

[1] Standard deviation of the mean for measured values in the field experiments.
[2] If the previous crop was a legume, the standard N rates was adjusted as follows: ((Std Optimum Yield x Std N factor) – legume credit); legume credit was 22 lb N/ac for soybean and 30 lb N/ac for peanut.
[3] If the previous crop was legume, the measured N factor was adjusted as follows: (Mea. Optimum N Rate + Legume Credit)/(Mea. Optimum Yield).
* Indicates the 95% confidence interval is different between the standard and measured values.