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VOLUME 2

USING THE PRESIDEDRESS NITRATE TEST TO CUT COSTS COSTS FOR NITROGEN FERTILIZER

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The amount of nitrogen (N) to apply to corn is an important crop management decision. Corn is very responsive to N. When too little N is applied, corn will readily show signs of N deficiency and lower crop yields. However, it is never profitable to apply more N fertilizer than can be used by the crop. Pollution of water supplies is also a concern from over-application of N.

Nitrogen supplied by manure applications can reduce fertilizer cost but corn growers need reliable information to determine how much N fertilizer rates can be reduced. The amount of N that will be supplied by a soil during the growing season is difficult to predict at time of corn planting. Nitrogen is sometimes over-applied at planting to guard against deficiency, without knowing how much N will become available from the soil.

Corn growers who delay most of the total N application to time of sidedressing can use the Presidedress Soil Nitrate Test (PSNT) as a guide to improve N recommendations. This in-season soil test does an excellent job of determining whether there is adequate N available in the soil to meet the needs of the corn crop. The PSNT is especially useful on manured fields where it is often expected that there may be adequate N available from the soil to meet the needs of the crop. The PSNT provides assurance that sidedress N fertilizer rates can be reduced without affecting yield on soils that are high in available N. On soils that test low in available N, the PSNT will indicate that sidedress N is needed. The procedures for the PSNT are explained in a fact sheet available through Rutgers Cooperative Extension (FS 569 - Nitrogen Recommendations for Corn Using the Presidedress Soil Nitrogen Test).

NEW JERSEY PSNT FIELD TRIALS

Field trails were conducted at 30 locations from 1990 to 1994 to evaluate the PSNT on New Jersey soils. At each location only 20 lbs. of nitrogen was applied at planting in the row. When the corn plants were 12 inches tall (6 leaf stage) soil samples were taken from the 0-12 inch depth. The soil samples were dried and analyzed for nitrate according to the procedures for the PSNT. At twenty locations, the fields were divided into plots which received different rates (0, 25, 50, 75, 100, 125, 150, 175, 200, and 225 Lbs N/Acre as NH_4NO_3) of sidedress nitrogen. At ten locations, only control plots without sidedress N were compared to plots that received an adequate rate of sidedress N. These treatments were replicated 4 times in each experiment. Grain yields were determined by harvesting 70 ft. of row length in each plot by hand. The soil nitrate and yield data collected from these trials help to better predict the need for sidedress N when using the PSNT.

The relationship between nitrate-N (NO_3-N) concentration and relative field corn grain yield are shown in Figure 1. The results show that when the NO_3-N concentration in the soil is 22 ppm or greater, grain yield is unlikely to be improved with the application of sidedress N. These field calibration data from New Jersey are in close agreement with other states. Vermont, Pennsylvania, New York, Connecticut, Maryland, and Delaware are using PSNT critical concentrations in the range of 21 to 25 ppm to predict the need for sidedress N. The critical concentration is defined as the value that separates N responsive soils from non-responsive soils. As research continues, Rutgers Cooperative Extension is using 25 ppm as the critical concentration. Thus, when the PSNT value is 25 ppm or greater, no sidedress N will be recommended.

The grain yield responses to sidedress N rates are shown for twenty different field trials (figures 2-21) conducted over a four year period, 1991-1994. The various locations represent a range of soils, cropping histories, manure application, and tillage practice. The yield responses to sidedress N at each site can be compared to what the PSNT recommends (Table 1) based on the soil NO_3-N concentration and the actual yield obtained. The cost of fertilizer N was based on $0.30

per Lb of N. Manure credits were based on values given in Rutgers Field Crop Production Recommendations.

Table 1. Sidedress Nitrogen Recommendations for Corn Using the PSNT[1]

Soil Test Level NO_3-N	Corn Yield Goal, grain (bu/A)/silage (T/A)				
	100/17	125/21	150/25	175/29	200/33
	------Sidedress N Recommendation (Lbs N/A)[2]------				
0 to 10	100	125	150	175	200
11 to 15	75	100	125	150	150
16 to 20	50	75	100	125	125
21 to 25	25	50	75	100	100
25 +	0	0	0	0	0

[1]*Adapted from Pennsylvania State University*

[2]*When more than 100 Lbs of sidedress N are recommended on very light sandy soils, apply half of the sidedress when the corn is 12 inches tall, and half when the corn is 18 to 24 inches tall.*

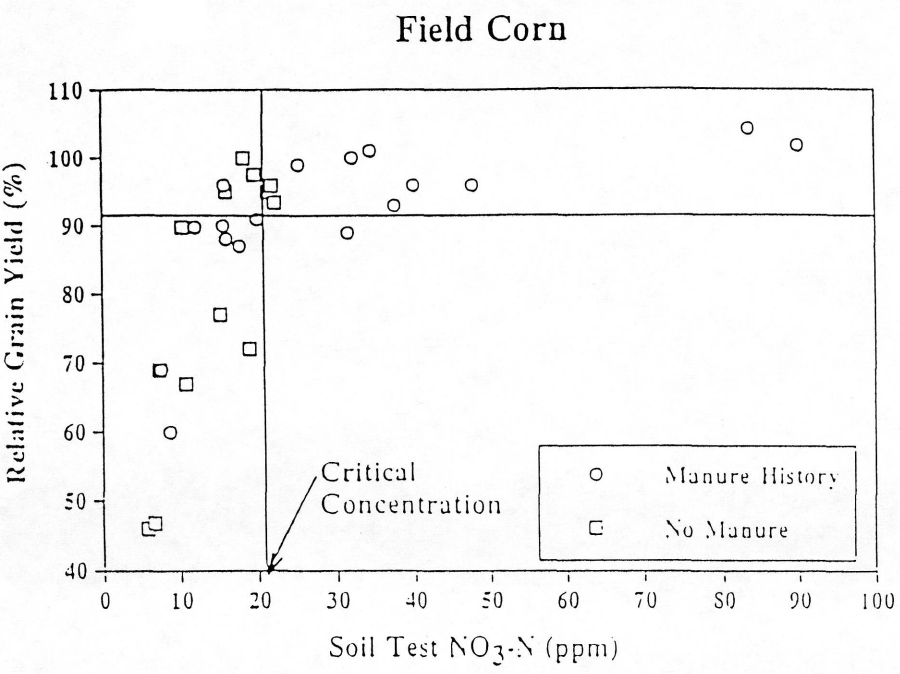

Figure 1

Relative field corn yield as a function of soil NO_3-N concentration in the surface 12 inches of soil when plants are 12 inches tall. The critical concentration separates responsive from non-responsive soils.

1991 On-Farm PSNT Field Trial With Manure
Hazen loam, Warren Co., NJ

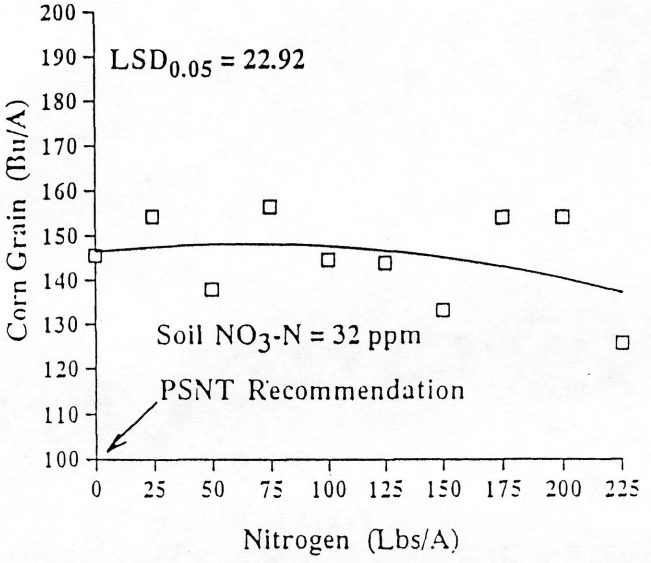

Figure 2

This PSNT trial was conducted in a field that received dairy manure before corn planting. Because the soil NO_3-N concentration was 32 ppm in the top 12 inches of soil before sidedressing, the PSNT recommended 0 Lbs N/A. The lack of a yield response indicates that the PSNT provided a good measure and credit for N availability in this manured soil.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	150	$45
Using manure credit:	100	$30
PSNT recommendation:	0	0

1991 PSNT Field Trial With Manure
Rutgers Snyder Research and Extension Farm
Quakertown silt loam, Hunderton Co., NJ

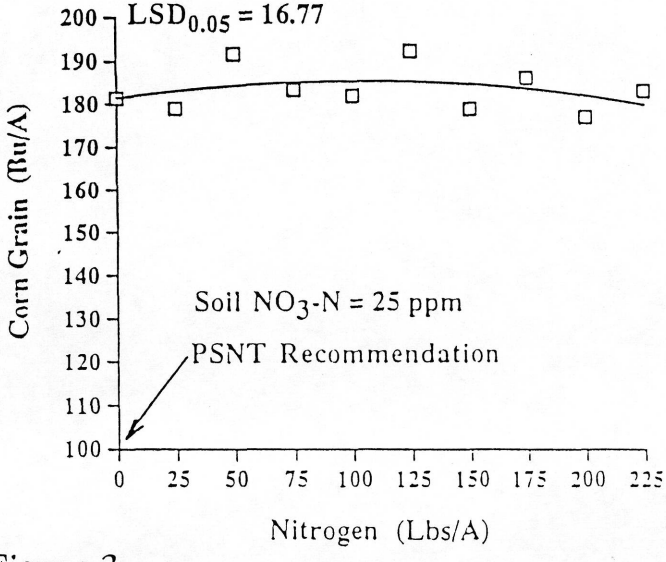

Figure 3

This PSNT trial was conducted in a field that was previously sod and received dairy manure before corn planting. Because the soil NO_3-N concentration was 25 ppm before sidedressing, the PSNT recommended 0 Lbs N/A. This PSNT value is right at the critical concentration that separates responsive from nonresponsive soils. The lack of a significant yield response indicates that the PSNT recommendation was correct.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	180	$52
Using manure credit:	130	$39
PSNT recommendation:	0	0

1991 PSNT Field Trial With Manure
Rutgers Plant Science Research Farm
Freehold sandy loam, Monmouth Co., NJ

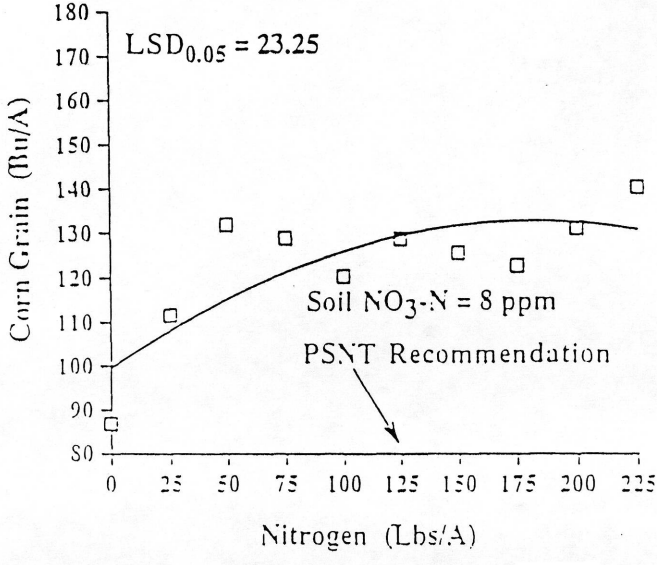

Figure 4

This PSNT trial was conducted in a field that was cropped to soybean the previous year and received dairy manure with woodchip bedding before corn planting. The soil NO_3-N concentration was 8 ppm. The woodchip bedding material immobilized soil N which was reflected in the low soil NO_3-N concentration. This trial shows that using the PSNT can help to identify soils that are lower in N availability than might be expected. Because the NO_3-N concentration is is less than 10 ppm, the sidedress N recommendation is based on applying 1 Lb N per bushel of expected yield.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	125	$38
PSNT recommendation:	125	$38

1991 PSNT Field Trial Without Manure
Sassafras sandy loam, Middlesex Co., NJ

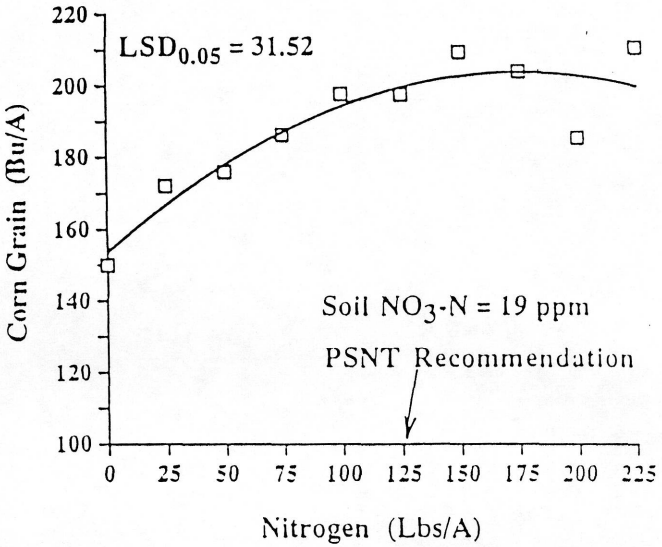

Figure 5

This PSNT trial was conducted in a field without manure application. The field was in continuous no-tillage corn production for 18 years. The soil NO_3-N concentration was 19 ppm. The PSNT recommended 125 Lbs N/A for a yield goal of 200 Bu/A. The yield response to sidedress N rates indicates that the PSNT recommendation was adequate for 98% maximum yield.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	200	$60
PSNT recommendation:	125	$38

1991 PSNT Field Trial Following Alfalfa
Sassafras sandy loam, Burlington Co., NJ

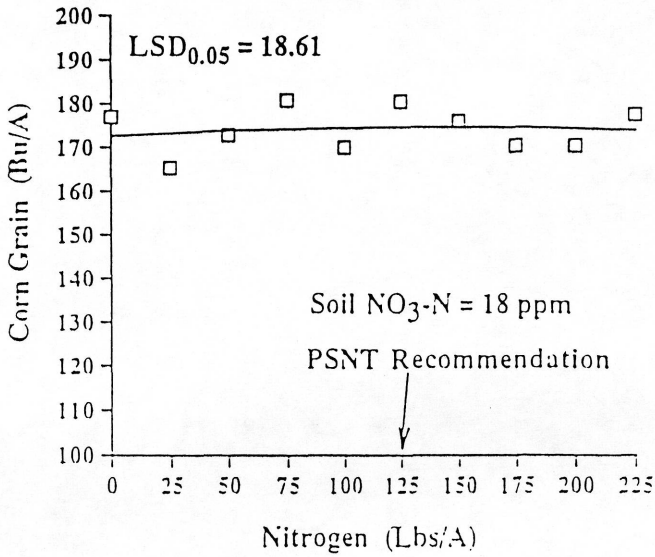

Figure 6

This PSNT trial was conducted in a field where the previous crop was alfalfa. The soil NO_3-N concentration was 18 ppm. The PSNT would recommend 125 lbs. N/A sidedress for a yield goal of 175 Bu/A. The lack of a yield response to sidedress N indicates that there was sufficient N available from the previous alfalfa crop. Over-recommendation of N by the PSNT can occur when corn follows a forage legume because the N apparently mineralizes more slowly from legumes residues than from manure. The PSNT sometimes does not give a proper credit to preivous alfalfa stands. When corn follows alfalfa, it is advisable to base N credits on percent stand of alfalfa.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	170	$50
Using manure credit:	120	$27
PSNT recommendation:	125	$38

1991 PSNT Field Trial With Manure
Chalfont silt loam, Hunterdon Co., NJ

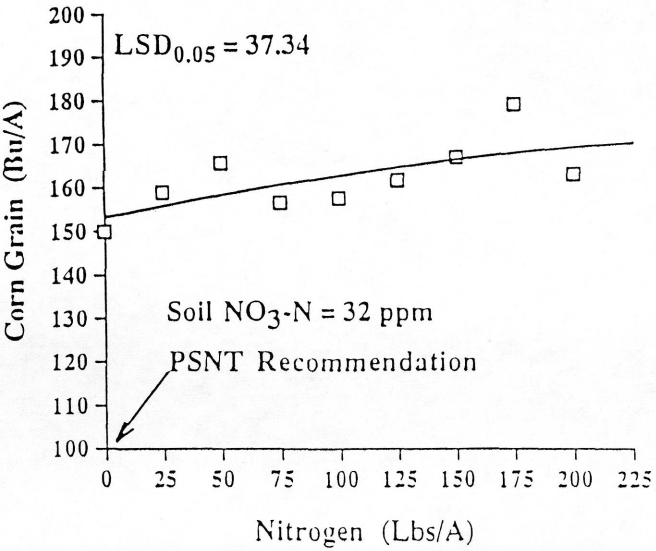

Figure 7

This PSNT trial was conducted in a field that received cattle manure containing newspaper bedding. The soil NO_3-N concentration was 32 ppm. The PSNT recommended that sidedress N was not needed. There was a slight yield response to sidedress N rates but the increases were not significant. The PSNT recommendation was adequate for 92% maximum yield.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	160	$48
Using manure credit:	110	$33
PSNT recommendation:	0	0

1992 PSNT Field Trial Without Manure
Rutgers Plant Science Research Farm
Freehold sandy loam, Monmouth Co., NJ

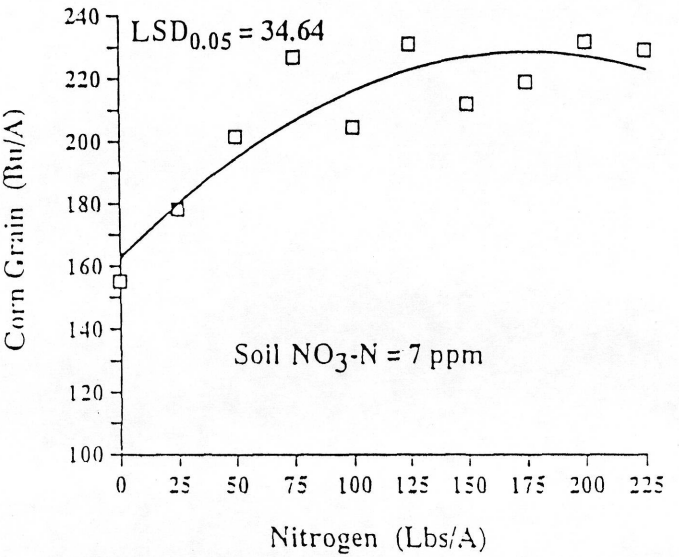

Figure 8

The PSNT trial was conducted in a field without manure. The soil NO_3-N concentration was only 7 ppm. Because the NO_3-N concentration is less than 10 ppm, the sidedress N recommendation is based on applying 1 Lb N per bushel of expected yield.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	200	$60
PSNT recommendation:	200	$60

1992 PSNT Field Trial With Manure
Rutgers Snyder Research and Extension Farm
Quakertown silt loam, Hunterdon Co., NJ

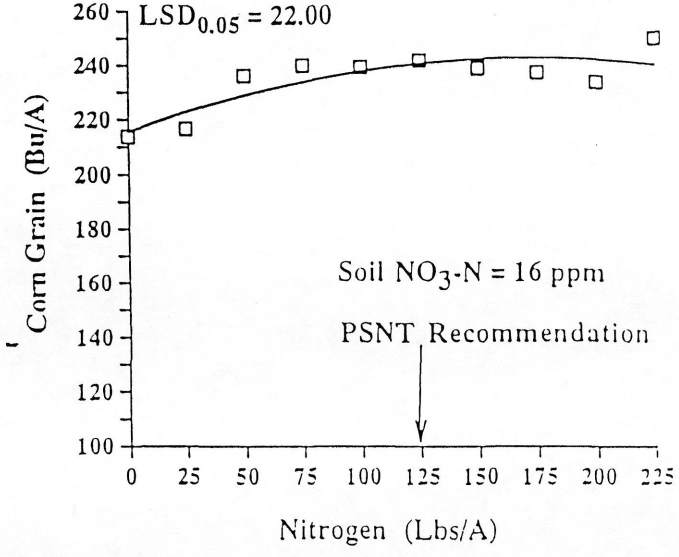

Figure 9

This PSNT trial was conducted in a field that received dariy manure before corn planting. The soil NO_3-N concentration was 16 ppm. The PSNT would recommend 125 Lbs N/A. The results show that the recommendation was adequate for this field even though the yield achieved was greater than 200 Bu/A.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	200	$60
Using manure credit:	150	$45
PSNT recommendation:	125	$38

1992 PSNT Field Trial Without Manure
Rutgers Snyder Research and Extension Farm
Quakertown silt loam, Hunterdon Co., NJ

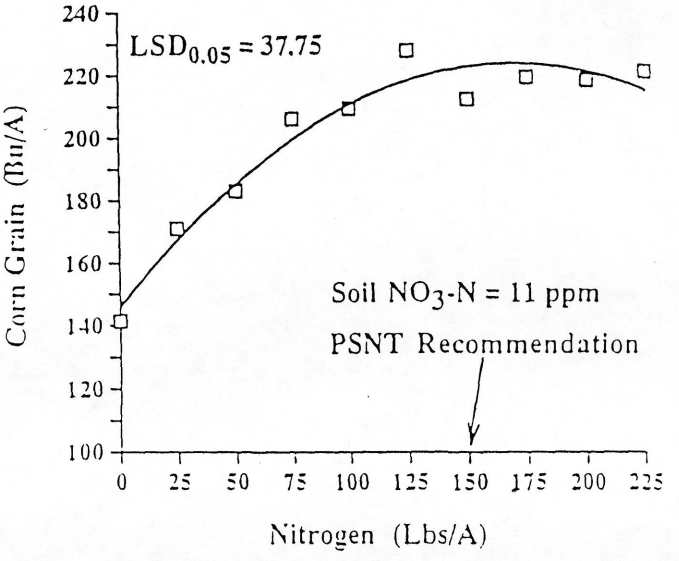

Figure 10

This PSNT trial was conducted in the same field as that shown in Figure 9, but it did not receive manure. The soil NO_3-N concentration was only 11 ppm compared to that in the adjacent PSNT trial where it was 16 ppm. The results show that this soil was more responsive to nitrogen than the manured trial (Figure 9). The PSNT would recommend 150 Lbs N/A. This was found to be adequate even though the yield level achieved was greater than 200 Bu/A.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	200	$60
PSNT recommendation:	150	$45

1992 PSNT Field Trial With Manure
Rutgers Plant Science Research Farm
Freehold sandy loam, Monmouth Co., NJ

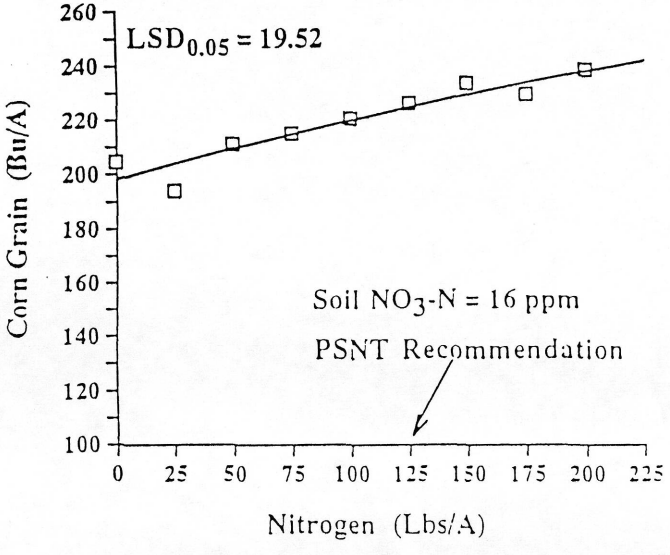

Figure 11

This PSNT trial was conducted in a field that received an application of poultry manure. The soil NO_3-N concentration was 16 ppm. The PSNT recommended 125 Lbs N/A for a yield goal of 200 Bu/A. The PSNT recommendation was adequate for 95% of maximum yield. Nitrate leaching may have been a factor influencing crop response. A 5 inch rain occurred at this site soon after sidedress N was applied.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	200	$60
Using manure credit:	75	$23
PSNT recommendation:	125	$38

1992 On-Farm PSNT Field Trial With Manure
Washington loam, Warren Co., NJ

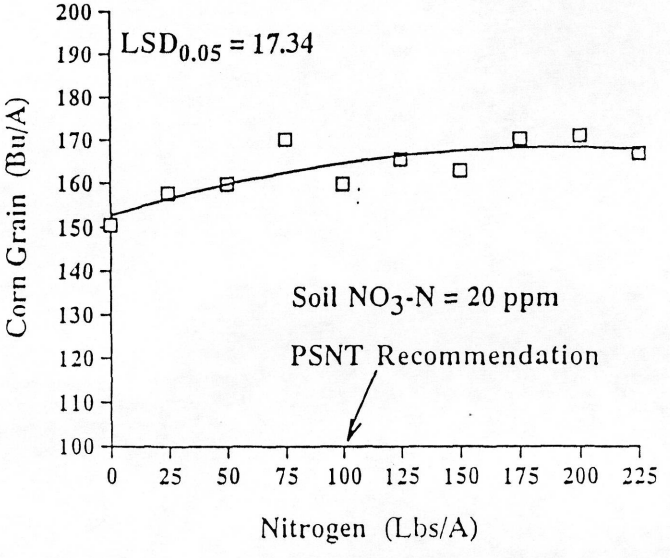

Figure 12

This PSNT trial was conducted in a field that has a several year history of manure application. The soil NO_3-N concentration was 20 ppm. The PSNT would recommend 100 Lbs N/A sidedress for a yield goal of 160 Bu/A. The modest yield response to nitrogen shows that the PSNT recommendation was more than adequate for this field.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	160	$48
Using manure credit:	110	$33
PSNT recommendation:	100	$30

1992 On-Farm PSNT Field Trial With Manure
Chalfont silt loam, Hunterdon Co., NJ

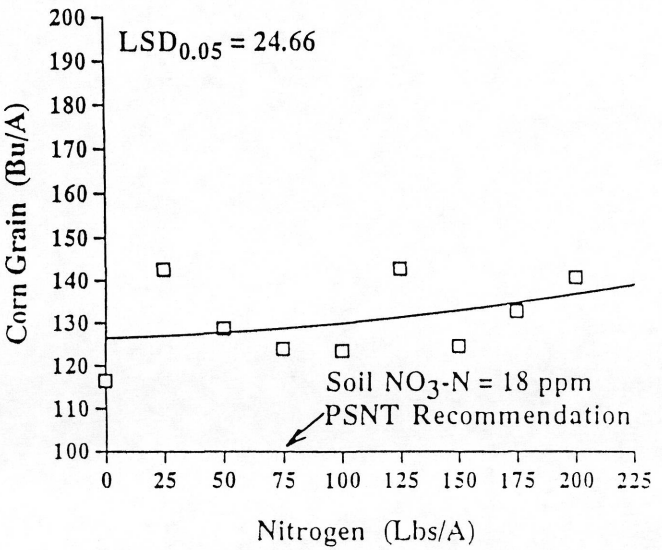

Figure 13

This PSNT trial was conducted in a field that has a several year history of manure application. The soil NO_3-N concentration was 18 ppm. The PSNT recommended 75 Lbs N/A for a yield goal of 125 Bu/A. This recommendation was found adequate.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	130	$39
Using manure credit:	80	$24
PSNT recommendation:	75	$23

1993 On-Farm PSNT Field Trial With Manure
Washington loam, Sommerset Co., NJ

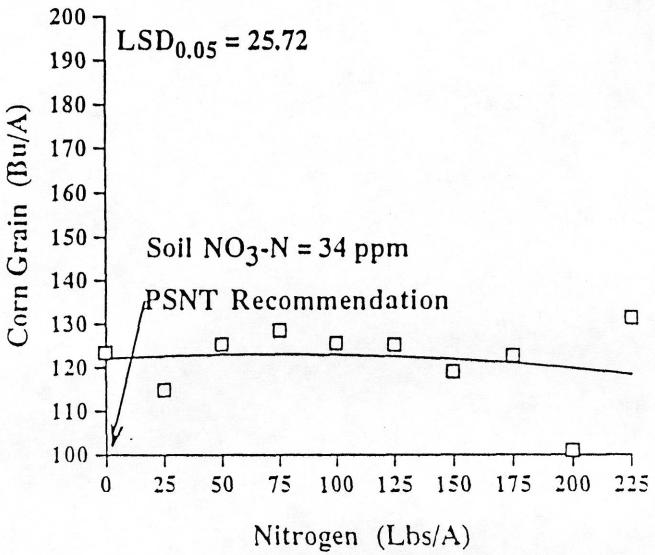

Figure 14

This PSNT trial was conducted in a field that has a several year history of manure application. The soil NO_3-N concentration was rather high; 34 ppm. The PSNT recommended no sidedress N. The lack of a yield response indicates that the PSNT correctly predicted that sidedress N was not needed.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	125	$38
Using manure credit:	75	$23
PSNT recommendation:	0	0

1993 On-Farm PSNT Field Trial With Manure
Califon loam, Warren Co., NJ

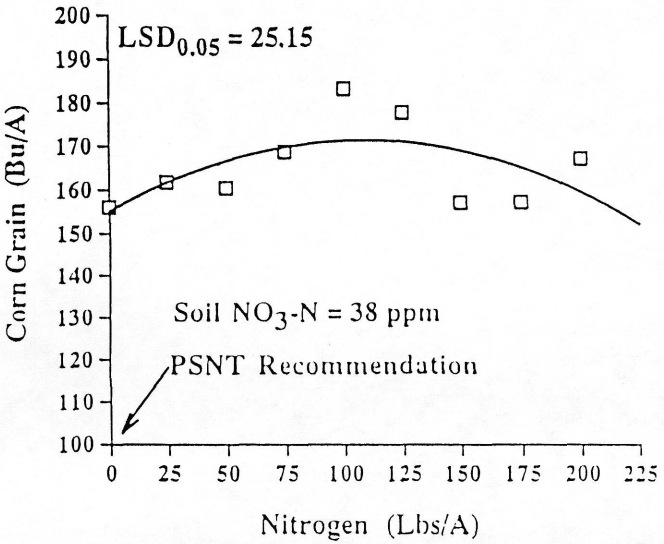

Figure 15

This PSNT trial was conducted in a field that received poultry manure before corn planting. The soil NO_3-N concentration was high, 38 ppm. Sidedress N was not recommended by the PSNT. The response to sidedress N was not statistically significant.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	170	$51
Using manure credit:	50	$15
PSNT recommendation:	0	0

Rutgers Plant Science Research Farm
Freehold sandy loam, Monmouth Co., NJ

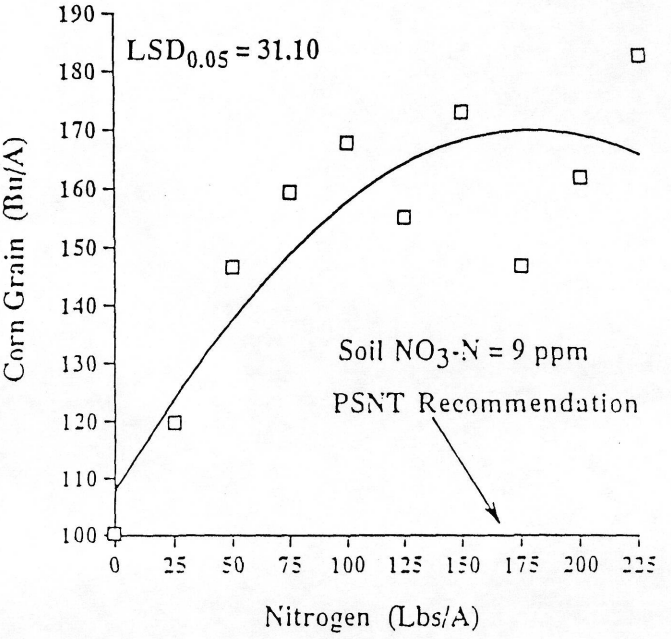

Figure 16

This PSNT trial was conducted in a field that received dairy manure before corn planting. The soil NO_3-N concentration was only 9 ppm even though the soil was manured. This field trial shows that the PSNT can help to identify soils that may be lower in N availability than expected. There was a strong response to sidedress N. Sidedress N recommendation is based on applying 1Lb N per bushel of expected yield.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	160	$48
Using manure credit:	110	$33
PSNT recommendation:	160	$48

1993 PSNT Field Trial Following Soybean
Rutgers Plant Science Research Farm
Freehold sandy loam, Monmouth Co., NJ

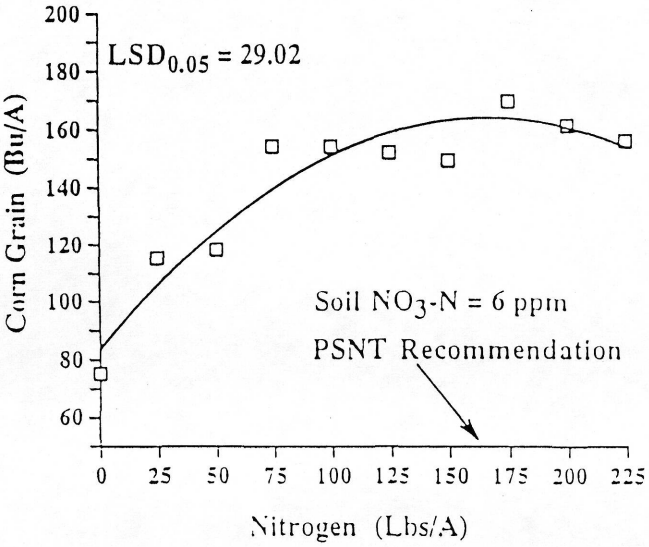

Figure 17

This PSNT trial was conducted in a field where the previous crop was soybean. The soil NO_3-N concentration was only 6 ppm. The PSNT recommended 160 Lbs N/A. This recommendation was found adequate.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	160	$48
PSNT recommendation:	160	$48

1993 PSNT Field Trial Following Kentucky Bluegrass Sod
Rutgers Plant Science Research Farm
Freehold sandy loam, Monmouth Co., NJ

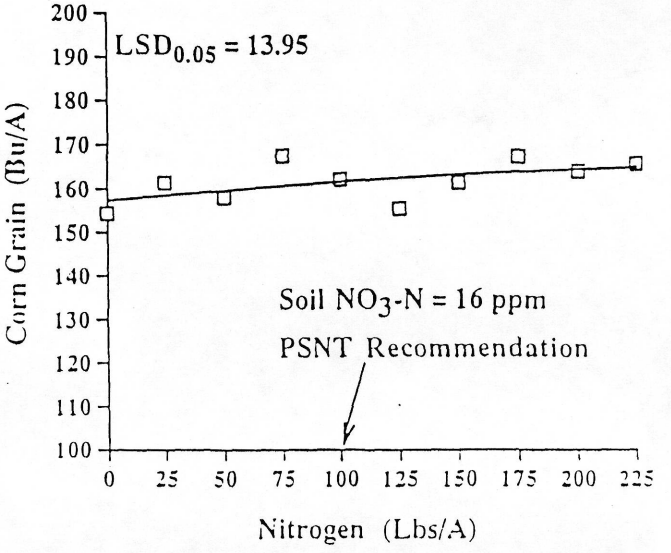

Figure 18

This PSNT trial was conducted in a field that was plowed after it had been in Kentucky bluegrass sod for ten years. The soil NO_3-N concentration was 16 ppm. There appeared to be only a slight response to nitrogen and it was not significant. The PSNT would have recommended 100 Lbs N/A. The PSNT tends to recommend more nitrogen than is needed when corn is grown in fields where sod is plowed under.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	160	$48
PSNT recommendation:	100	$30

1994 PSNT Field Trial Without Manure
Rutgers Snyder Research and Extension Farm
Quakertown silt loam, Hunterdon Co., NJ

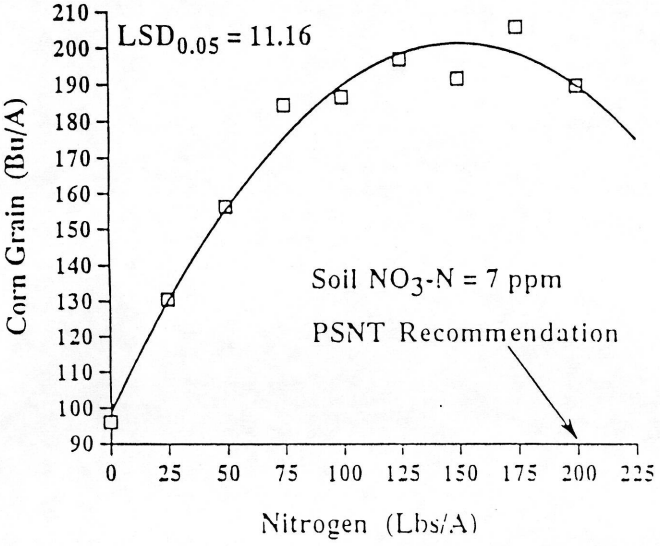

Figure 19

This PSNT trial was conducted in a field where the previous crop was rye grain. The soil NO_3-N concentration was only 7 ppm. Because the NO_3-N concentration is less than 10 ppm, the sidedress N recommendation is based on applying 1 Lb N per bushel of expected yield.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	200	$60
PSNT recommendation:	200	$60

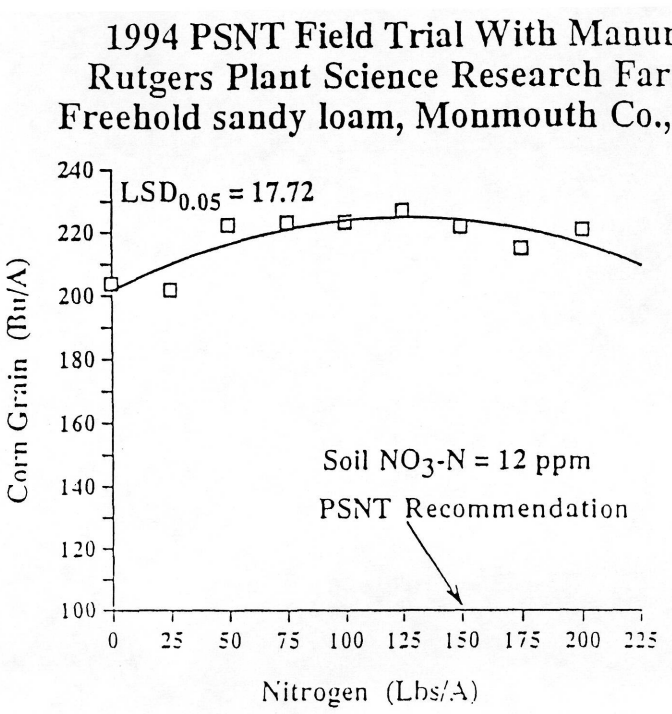

Figure 20 (Compare to Figure 21)

This PSNT trial was conducted in one half of a field that received a heavy application of elephant manure (from Great Adventure) before planting. The manure application apparently resulted in only a slight increase in soil nitrogen availability. The adjacent half of the field (Figure 21) was not manured. The soil NO_3-N concentration was 12 ppm in the manured section and 10 ppm in the section without manure. The response of corn to sidedress N rates was also very similar with and without manure. This trial shows that the PSNT can help to identify soils that may have a lower nitrogen availability than may be expected from a manure applicaiton (continued under Figure 21).

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	200	$60
Using manure credit:	150	$45
PSNT recommendation:	150	$45

1994 PSNT Field Trial Without Manure
Rutgers Plant Science Research Farm
Freehold sandy loam, Monmouth Co., NJ

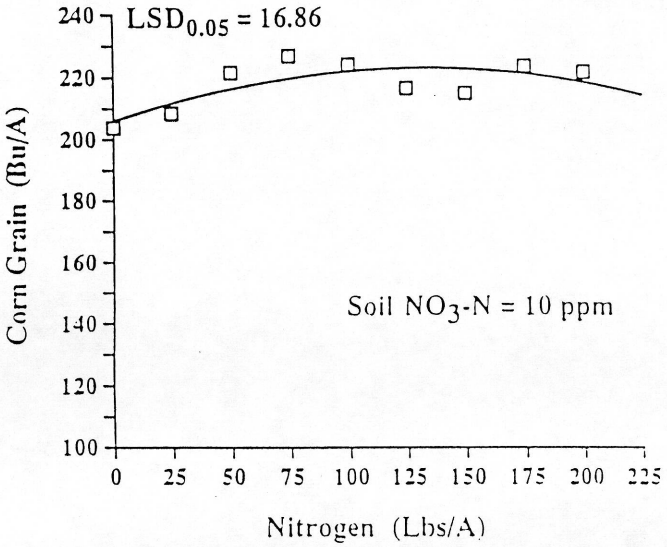

Figure 21

Continued:

The PSNT would have recommended 150 Lbs N/A for the manured section. The PSNT recommendation was found to be somewhat greater than needed. Applying 1 Lb N per bushel of expected yield was also found to over recommend N on the field section without manure. These results show that the PSNT recommendation protects from under-application.

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	200	$60
PSNT recommendation:	200	$60

Summary of Findings from PSNT Trials

1. Observations from 30 New Jersey locations shows that the PSNT is a good predictor of the need for sidedress N. When the soil nitrate concentration measured by the PSNT is less than 25, sidedress N should be applied. When it is greater than 25, sidedressing is not recommended.

2. The PSNT is most useful on soils where manure has been applied. It helps to provide greater confidence in reducing N applications on manured soils. It also helps to identify soils that may have less N available than might be expected from a manured application.

3. The PSNT provides acceptable N rate recommendations when sidedressing is needed on manured fields. The PSNT sometimes recommends more N than is actually needed. This is because the recommendations were developed to protect the crop from under fertilization.

4. On average, the PSNT recommends less N than the traditional method of applying 1 Lb N per bushel of expected yield or when making adjustments for manure credits.

Average of 20 locations

Basis For N Fertilizer Recommendation	Lbs N/A	$/A
Applying 1 Lb N per bushel:	173	$55
Using manure credit:	135	$40
PSNT recommendation:	106	$32

5. Soils that have not received manure generally have low soil NO_3-N concentrations. The PSNT is not very useful on these non-manured soils. Recommendations based on applying 1 Lb N per bushel of expected yield were found to provide adequate N. There was no indication that more than 1 Lb N per bushel was needed even at high yield levels.

6. When corn follows alfalfa, the N rate should be reduced by using the legume credits in the Rutgers Field Crop Production Recommendations.

Acknowledgements

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