2004 DRY BEAN YIELD TRIALS

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Twenty-six yield trials were conducted in 2004 in Saginaw, Montcalm, East Lansing and Presque Isle counties in addition to 20 acres of early generation nurseries under development in 10 different market classes. At the Saginaw Valley Bean & Sugarbeet Research Farm, 18 yield trials were planted on nine acres. These included a 49-entry standard navy bean test; a 81-entry standard black test, a 72-entry preliminary navy bean test; seven preliminary black bean tests (range 18-100 entries); a 30-entry standard pinto bean test; a 25-entry standard great northern test; 30-entry preliminary great northern bean test; a 30-entry standard red and pink bean test; 20-entry preliminary red and pink bean test; a 16-entry standard vine cranberry test; 20-entry Tebo bean test; and a 25-entry Midwest Performance Trial with pintos and great northerns from Michigan, Nebraska, North Dakota, and Colorado. At the Montcalm Research Farm, seven yield trials were planted on five acres. These included a 56-entry standard red and white kidney trial, 16-entry preliminary kidney bean test; a 36-entry standard bush cranberry test, a 64-entry variety trial to evaluate reaction to white mold was grown under sprinkler irrigation, a second 64-entry genetic study to evaluate for resistance to white mold, and two 30-entry genetic studies on drought tolerance in cranberry beans. A 16-entry regional trial was conducted cooperatively in Presque Isle County with new navy, black, pinto, great northern, small red, pink, and kidney bean varieties to give growers in this region an opportunity to see other market classes.

The 2004 field season proved to be quite challenging for bean production due to wet planting conditions followed by below normal precipitation (5” less) from June through September. There was only one significant rainfall (9/6 -0.46”) during period from 8/30-10/13. The extreme drought dramatically hastened maturity particularly in full-season varieties and resulted in a small plant biomass that favored the production of the earlier-maturing entries such as pintos and great northerns whereas the full season navy and black bean lines did not reach full potential due to stress hastened maturity. Yields were below average in 2004 particularly in direct harvested nurseries as plant size was small. Dry conditions resulted in seed coat check problems and small seed size in the commercial crop as was observed in data on seed size in the attached tables. In addition to the weather, field location played a role in overall productivity on the B&B Farm. Nurseries planted on Range 1 showed considerably more stress, smaller plants lower productivity. These included all small-seeded nurseries except Expts. 4107 and 4109 which were planted north of Swan Creek Road along with all the medium-seeded tests. All small-seeded nurseries were direct harvested in 2004 and all medium-seeded tests were rod pulled which also was reflected in yields, as there was considerable seed loss in nurseries on Range 1 due to small plant size and low pod location within the plant. Yield data from Range 1 ranged from highs of 22 to 31 cwt/acre versus 29 to 36 cwt/acre for nurseries planted north of Swan Creek. Average yields fell below 15-20 cwt/acre, compared to a statewide average of 17 cwt/acre for the commercial crop. At the Montcalm Research Farm with access to irrigation, plot yields were above average. In the white mold trial, that was irrigated 11 times for total of 5”to promote disease development, top yields exceeded 44 cwt/acre, whereas the top yields in kidney and cranberry beans was lower (34-38 cwt/acre). In addition to the standard kidney, cranberry and white mold trials at Montcalm, research was conducted genetic resistance to white mold.

The data for all tests are included in an attached section. Procedures and details on nursery

establishment and harvest methods are outlined on the first page. Since the data collected on each test are basically the same, a brief discussion of each variable measured is presented below for clarification purposes.

1. Yield is clean seed weight reported in hundredweight per acre (cwt/acre) standardized to 18% moisture content. Dry beans are commercially marketed in units of 100 pounds (cwt).

2. Seed weight is a measure of seed size, determined by weighing in grams a pre-counted sample of 100 seeds, known as the 100-seed weight. To convert to seeds per 100g (10,000/100 seed wt); for example 100-seed weight of 50 converts to 200 seeds per 100 g (used in marketing).

3. Days to flower is the number of days from planting to when 50% of plants in a plot have one or more open flowers.

4. Days to maturity is the actual number of days from planting until date when all the plants in a plot have reached harvest maturity.

5. Lodging is scored from 1 to 5 where 1 is erect while 5 is prostrate or 100% lodged.

6. Height is determined at physiological maturity, from soil surface to the top of plant canopy, and is recorded in centimeters (cm).

7. Desirability score is a visual score given the plot at maturity that takes into consideration such plant traits as; moderate height, lodging resistance, good pod load, favorable pod to ground distance, uniformity of maturity, and absence of disease, if present in the nursery. The higher the score (from 1 to 9) the more desirable the variety, hence DS serves as a subjective selection index.

At the bottom of each table, the mean or average of all entries in a test is given to facilitate comparisons between varieties. In order to better interpret data, certain statistical factors are used. The LSD values refer to the Least Significant Difference between entries in a test at two levels of probability. The LSD value is the minimum difference by which two entries must differ before they can be considered significantly different. Two entries differing in yield by 1 cwt/acre cannot be considered as performing significantly different if the LSD value is greater than 1 cwt/ acre. Such a statement is actually a statement of "probable" difference. We could be wrong once in 20 times (p=0.05), on the average, or once in 100 times (p=0.01) depending on the level of probability. The other statistic, Coefficient of Variation (CV), indicates how good the test was in terms of controlling error variance due to soil or other differences within a location. Since it is impossible to control all variability, a CV value of 10% or less implies excellent error control and is reflected in lower LSD values. Under the pedigree column, all released or named varieties are **bolded** and always preceded by a comma (,); when preceded by a slash (/), the variety was used only as a parent to produce that particular breeding line.

Expt. 4101: Standard Navy Bean Yield Trial

This 49-entry trial included standard commercial navy bean varieties, breeding lines entered through the Cooperative Dry Bean Nursery (CDBN) and advanced lines from the MSU breeding program, which carry the N-prefix. Yields ranged from 9 to 22 cwt/acre with a mean of 16 cwt/acre. The trial was very not very uniform due to moisture stress hence variability was high (CV=12.6%) and the LSD needed for significance was 2.8 cwt/acre. Eleven entries significantly out-yielded the test mean and these included the varieties, Schooner, Scepter and Comet. As in 2003, full season varieties such as Vista and Mayflower were significantly lower yielding due to the drought. Seahawk was average in this trail (15 cwt/acre). The trial favored earlier season varieties such as the top-yielding entry N00833 that has been regarded as too early in past years. The second entry in the test N02237 derived from the cross of Seahawk/Jaguar was the top yielding entry in test 3101 in 2003.

Expt. 4102: Standard Black Bean Yield Trial

This 81-entry trial included the standard commercial black bean varieties including advanced breeding lines. Yields ranged from 10 to 23 cwt/acre with a mean for the test of 16 cwt/acre. Variability was well controlled in this test, (CV=13.2%) and the LSD was 3.0 cwt/acre. Twelve lines, including 43-11M a sister line of 115-11M (I01892) derived from a cross with a wild bean, were significantly higher yielding than the test mean. B01741 that also topped tests 3102 and 2106 in 2003 and 2002, respectively, continues to show potential and ranked fifth in this test. Among the top yielding entries were two lines from Mexico B01451 and B01457, and line ND9902986 from NDSU. The new black bean variety Condor yielded above all commercial entries in the trial equal to 115M at 18 cwt/acre. Other commercial varieties, T-39, Midnight, Jaguar, Eclipse, Blackhawk and Phantom were significantly lower yielding in this test due to the late season moisture stress. Even the drought tolerant line L88-63 (B02596) yielded equivalent to Jaguar and the test mean at 16 cwt/acre.

Expt. 4103: Preliminary Black Bean Yield Trial

This 42-entry trial included new black bean breeding lines (prefix B04---) from the MSU program with potential resistance to anthracnose. Yields ranged from 8 to 22 cwt/acre with a mean for the test of 16 cwt/acre. Variability was not well controlled in this 3-rep test (CV=18.7%) despite being direct harvested and the LSD was 5 cwt/acre. As a result only 2 lines B04222 and B04240 significantly out-yielded the test mean including the check variety, Jaguar (15.2 cwt/acre). None of the entries significantly outyielded the Condor check. Only those entries with canning quality equivalent to Condor will be advanced in 2005.

Expts. 4104-4107: Preliminary Black Bean Yield Trials

These four trials were established to study inheritance of high yield in black beans derived from an original cross with the Mexican black bean Tacana and a wild bean G24423 from Colombia. Four high yielding lines were identified in this cross: 48-21M (MSU accession I01891), 115-11M (I01892), 26-11M (I01893), and 39-11M (I01894). The most consistent high yielding line 115-11M has produced yields in excess off 50 cwt/acre in past seasons. The four lines were crossed with Jaguar and advanced using SSD to the F5 generation and the recombinant inbred lines (RILs) from

these four crosses entered preliminary yield trials in 2005. Tests 4104, 4105 and 4106 were planted on Range 1 where limited crop rotation combined with moisture stress to reduce overall productivity. Test 4107 was planted north of Swan Creek Road on a more productive section of the farm. Test 4104 derived from cross 26-11M/Jaguar had 64 entries and ranged in yield from 13 to 26 cwt/acre with a mean of 19 cwt/acre; test 4105 derived from cross 48-21M/Jaguar had 64 entries and ranged in yield from 14 to 31 cwt/acre with a mean of 23 cwt/acre; test 4106 derived from cross 115-11M/Jaguar had 100 entries and ranged in yield from 11 to 27 cwt/acre with a mean of 20 cwt/acre; and test 4107 derived from cross 39-11M/Jaguar had 100 entries and ranged in yield from 17 to 29 cwt/acre with a mean of 23 wt/acre. In all tests the two parents were included along with some additional checks if space permitted. Line 115-11M was planted in all tests and ranged in yield from 21 cwt/acre in tests 4104 and 4107 to 25 cwt/acre in 4106 and 26 cwt/acre in 4105, whereas the original parent Tacana only produced yields of 17-18 cwt/acre in all tests. Likewise, Jaguar ranged in yield from 18-21 cwt/acre and a number of entries significantly out-yielded the local adapted parent. Breeding line B01741 was included in test 4104 and was second in the trial at 25 cwt/acre. All four trials will be repeated in 2005 to continue to investigate yield potential in black beans.

Expt. 4108: Preliminary Navy Bean Yield Trial

This 72-entry trial included new navy bean breeding lines from the MSU breeding program, which carry the N-prefix. Yields ranged from 12 to 26 cwt/acre with a mean of 19 cwt/acre. The trial was somewhat variable thus variability was moderate (CV=10.8%) and the LSD needed for significance was 3.4 cwt/acre. Eleven entries significantly out-yielded the test mean and these included the varieties Vista and Mayflower. Seahawk was below average in this trail (18 cwt/acre). Two lines N04159 and N04103 exceeded 25cwt/acre despite the stress and only those entries with equivalent canning quality to Seahawk will be advanced in 2005.

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Expt. 4109: Preliminary Black Bean Yield Trial

This 100-entry trial included new black bean breeding lines (prefix B04---) from the MSU program with potential resistance to common bacterial blight (CBB). This trial was planted on more productive land north of Swan Creek Road. Yields ranged from 16 to 30 cwt/acre with a mean for the test of 23 cwt/acre. Variability was not well controlled in this 3-rep test (CV=12.8%) despite being direct harvested and the LSD was 4.7 cwt/acre. As a result only 5 lines significantly out-yielded the test mean and four of these entries significantly outyielded the Condor check. The top yielding entry B04644 had the highest desirability rating (6.5) in the test. Entries will be evaluated for markers linked to CBB and anthracnose, and only those entries with canning quality equivalent to Condor will be advanced in 2005.

Expt. 4110: Standard Great Northern Bean Yield Trial

This 25-entry trial included MSU great northern breeding lines and standard commercial check varieties and breeding lines entered as part of the Cooperative Dry Bean Nursery. The test ranged in yield from 23 to 33 cwt/acre with a mean yield of 29 cwt/acre. Variability was well controlled (CV= 5.2%) resulting in a low LSD value (2.2 cwt/acre) for significance. Yields in this and subsequent trials were much better than the black and navy tests since many of the entries matured earlier and were less affected by the drier conditions in August and September. These larger-seeded trials were

also rod pulled, not direct harvested like the small-seeded navy and black beans. Only four breeding lines significantly outperformed the test mean including the check variety Matterhorn. One promising line G02453 was the fifth entry in test 3104 in 2003. G02453 is a full-sib of GN line G02454 and pinto lines P02646 and P02647 which suggests that this pedigree has potential for enhancing yield of both pinto and great northern beans. The two other high-yielding entries sister lines G98601 and G98602 trace back to 1998 origins and continue to show potential for yield. Only those entries with improved dry seed quality and cracking resistance over Matterhorn will be advanced in 2005.

Expt. 4111: Standard Pinto Bean Yield Trial

This 30-entry trial included standard commercial pinto bean varieties, breeding lines entered through the Cooperative Dry Bean Nursery and advanced lines from the MSU breeding program that carry the P-prefix. The trial ranged in yield from 15 to 31 cwt/acre with a mean of 27 cwt/acre. Variability was well controlled (CV=7%) and the LSD needed for significance was 2.6 cwt/acre. Only four entries significantly out-yielded the test mean and these included Kodiak and new line ISB-5893 from Idaho Seed Bean Company. The line has a viney type habit and ranked low in desirability (3.0) less than traditional vine variety Othello (4.0). Buster ranked fifth in yield and was outside this group. One new line that showed potential with DS=6.5 was P04203.The line had a large seed (44g), 90-day maturity and lodging score of 2.0. The two full-sib lines P02646 and P02647 that showed potential in 2003 along with P02630 as possessing high yield, early maturity and architecture similar to Matterhorn produced disappointing low yields (26 cwt/acre) in this trial. One entry of interest was PS99-113E from USDA-WA program yielded 28 cwt/acre and has acceptable levels of resistance to CBB. Only those entries with equivalent canning quality to Othello will be advanced in 2005.

Expt. 4112: Standard Vine Cranberry Bean Yield Trial

This 16-entry trial was grown in Saginaw to identify those lines with improved performance over the check, Michigan Improved Vine Cranberry (Micran). The test included new lines from MSU developed from backcrossing bush cranberry line C97407 with NSL, a high-yielding root rot resistance vine bean from Mexico. Included in the test were two bush cranberry lines and the check was a new vine cranberry line 0759 from Asgrow. Yields ranged from 19 to 29 cwt/acre with a mean of 23 cwt/acre. Variability was moderate in this test (CV>9%) and LSD value of 2.9 cwt/acre was needed for significance. Only two lines significantly outyielded the test mean and the Micran check whereas three lines significantly outyielded Asgrow-759 (22 cwt/acre). The top entry C03153 was also the top entry behind black bean line B98311 in test 3224 in 2003. C03153 was 3 cwt/acre above the second entry in this test. C03151 ranked 3rd in tests 4112, 4224 and 3224. The performance of the bush cranberry lines C99804 and C99833 was average. Some of the lines had slightly smaller seed size than the check varieties (50g), but many of the entries were earlier maturing. This material represents new germplasm in the vine cranberry seed class and it has to be evaluated for canning quality. Only those entries with equivalent canning quality to MIC will be advanced in 2005.

Expt. 4213: Standard Bush Cranberry Bean Yield Trial

This 36-entry trial was conducted on the Montcalm Research Farm to compare new and standard bush cranberry bean varieties under supplemental irrigation (5 times total 2.75"). Many of the new lines originated from the same cross as the new vine cranberry lines. Rainfall on the farm was average for June (4.07"), July (2.33"), August (2.95"), but low in September (0.77") with only two significant rainfall events on 9/7 and 9/28. Yields ranged from 20 to 34 cwt/acre with a mean of 28 cwt/acre. Variability was high (CV=11.8%) in this test and the LSD needed for significance was high (4.7 cwt/acre). Only two lines significantly outyielded the test mean and these included two new lines derived from backcrossing program with black bean NSL from Mexico. The top yielding varieties, Cardinal and Hooter (29 cwt/acre) compared to Taylor Hort at 27 cwt/acre. The variety Talento Nano from Italy produced disappointing yield (26 cwt/acre) despite showing good adaptation, yields and curly top resistance in Idaho in 2003. Seed size varied from 58 g in Taylor Hort to 72 g in Hooter. A number of the new lines may not have acceptable seed size. C99833 was average in yield in 2004 but has shown consistent performance over years (2002-2003). It possesses a large seed size (71g) and is under consideration for variety release. Even though the market for bush cranberry is dry pack, only those entries equivalent to Hooter in canning quality will be advanced in 2005.

Expt. 4114: Standard Pink and Small Red Bean Yield Trial

This 30-entry trial included small red and pink breeding lines from the USDA program at MSU (USDA-MI) and USDA-WA (PS-prefix), new pink lines from MSU (S-prefix), standard commercial check varieties. The test ranged in yield from 19 to 30 cwt/acre with a mean yield of 24 cwt/acre. Variability was well controlled (CV=8.6%) resulting in a LSD value (2.9 cwt/acre) for significance. Three lines significantly outperformed the test mean but did not include the new small red variety, Merlot. The new pink line S00809 continued to show potential and ranked 7th between the two small red check varieties Merlot and Brooks. One surprise was the high yield of flor-de-mayo line K124467 from ADM, which topped the trial in 2004 and 2003. The second high-yielding entry S00105 was a pink line but had very unsatisfactory decumbent growth habit, hence low DS score (2.5). One small red from the USDA-MI program R02205 performed slightly above average and demonstrated common blight resistance in the field. The new Pink 9634 from UC Davis performed (24 cwt/acre) below the test mean. Only those small red entries equivalent to Merlot and pink lines equivalent to S00809 in canning quality will be advanced in 2005. S00809 is under consideration for release as the first pink variety from MSU.

Expt. 4115: Midwest Regional Performance Nursery (MRPN) Yield Trial

This 22-entry trial is conducted annually in cooperation with North Dakota (ND-prefix), Nebraska (ABCP-prefix) and Colorado (CO-prefix) in order to test new pinto and great northern lines from all four programs and access their potential in the different regions. Yield ranged from 21 to 31 cwt/acre with a mean of 27 cwt/acre. Variability was well controlled (CV=9.1%) resulting in a LSD value (4 cwt/acre) for significance. Only one variety Montrose was significantly higher in yield than the test mean, followed by the variety Matterhorn. The variety Buster yielded less than the test mean this year. Among the top lines included pinto from NDSU (ND020251) and the MSU great northern line G99727. The ABCP (Advanced Back-Cross Pinto) lines bred for CBB resistance were generally disappointing performers in this test with the exception of ABCP#8. This cooperative trial continues

to be valuable as it allows an evaluation of potential new lines prior to release in other states.

Expt. 4116: Preliminary Pink and Small Red Bean Yield Trial

This 20-entry trial included small red and pink breeding lines from the USDA program at MSU (USDA-MI) and USDA-WA (OT-prefix), new pink lines from MSU (S-prefix), standard commercial check varieties and breeding lines entered as part of the Cooperative Dry Bean Nursery. The test ranged in yield from 12 to 33 cwt/acre with a mean yield of 24 cwt/acre. Variability was high (CV=12.9%) resulting in a LSD value (4.9 cwt/acre) for significance. Only one line from USDA-WA significantly outperformed the test mean. New USDA small red line USRM-20 and MSU pink line S04508 outyielded the NW63 check variety. The new pink line S00809 continued to show potential and ranked 5th with a yield of 26 cwt/acre similar to yield in test 4114 and equal to yield of NW63. The test was atypical not displaying the normal stepwise staircase effect as the top entry was 6 cwt above the second entry and the bottom entry was 7 cwt less than previous entry. Rosada Nativa was clearly not adapted to Michigan conditions. Most of the pink entries were quite similar in appearance and yield as they traced to similar pedigree where Matterhorn was used as a parent. Small red line R97003 was average and does not demonstrate potential to surpass Merlot. Only those small red entries equivalent to Merlot and pink lines equivalent to S00809 in canning quality will be advanced in 2005.

Expt. 4117: Preliminary Tebo Bean Yield Trial

This 20-entry trial is the first attempt to develop a Tebo (Otebo) medium white bean with resistance to Bean Common Mosaic Virus (BCMV). Tebo is a specialty class that is exported to Japan for preparation of An paste. Included in the test were 17 backcross (BC3) lines similar to Tebo with resistance to BCMV. Virus resistance came from Matterhorn parent and was backcrossed 3-times to the Hime Tebo parent to recover Tebo plant and seed type. In addition to the 17 experimental lines with the G-prefix, check varieties Tebo, Matterhorn and Seahawk were planted. The test ranged in yield from 22 to 32 cwt/acre with a mean yield of 25 cwt/acre. Variability was well controlled (CV=8.6%) resulting in a LSD value (3.5 cwt/acre) for significance. Only the two check varieties Matterhorn and Tebo significantly outperformed the test mean. All the new breeding lines with virus resistance were lower yielding that the Tebo parent. Most lines were similar in seed size and maturity to the parent (29g) ranged from 28-32 g and some lines were a few days (88 days) earlier than the parent (91 days). Otherwise the lines resembled the Tebo parent in plant type, height and lodging resistance. Seven of the lines were not significantly lower yielding than Tebo parent and will be retested in 2005. Given that none of the lines outyielded the parent, only the best lines will be backcrossed to Tebo to recover the yield potential of the original parent.

Expt. 4118: Preliminary Great Northern Bean Yield Trial

This 30-entry trial included MSU great northern breeding lines and standard commercial check varieties and breeding lines entered as part of the CDBN. The test ranged in yield from 25 to 36 cwt/acre with a mean yield of 22 cwt/acre. Variability was well controlled (CV= 7%) resulting in LSD value (3.6 cwt/acre) for significance. Only three breeding lines significantly outperformed the test mean not including the check variety Matterhorn. One promising line G04510 originated from 3-way cross to introduce white mold tolerance into GN from G99750 (avoidance) and the navy line

N00904. A number of lines from the same cross were evaluated in this test. Top yielding entry ISB-4071 was a very early viny line with a low DS score (2.5) that escaped the dry fall conditions. In addition a line from USWA program PS01-130 showed potential. The new variety Bighorn was average and has a decumbent growth habit. Only those entries with improved dry seed quality and cracking resistance over Matterhorn will be advanced in 2005.

Expt. 4219: Standard Kidney Bean Yield Trial

This 56-entry trial was conducted on the Montcalm Research Farm to compare the performance of standard and new light red kidney (LRK), dark red kidney (DRK) and white kidney (WK) bean varieties from MSU and CDBN under supplemental irrigation (5 times total 2.75"). Yields ranged from 25 to 38 cwt/acre with a mean of 31 cwt/acre. Variability was high (CV=11.9%) resulting in a large LSD value (5.2 cwt/acre) needed for significance. Overall yields in this test were very high compared to previous years and surprisingly exceeded yields in bush cranberry test 4213. Four entries significantly outyielded the test mean and these included two new DRK lines (crosses with NSL), white kidney K01974 and a LRK entry from NY (V96-18). Check varieties yielded well CELRK (36), Beluga (35), Red Hawk and Chinook 2000 yielded 34 cwt/acre. The new Redcoat Soldier bean produced a disappointing 26 cwt/acre. One of the lowest yielding entry was USWA-70 LRK produced only 25 cwt/acre. White kidney line K01974, which ranked 2nd was the highest yielding entry in 2003 and ranked 2nd after Chinook 2000 in 2002. Since canning quality is vital in kidney beans, only those DRK lines equivalent in canning quality to Red Hawk, LRK lines equal or better than CELRK and WK lines equivalent to Beluga will be advanced in 2005.

Expt. 4220: Preliminary Kidney Bean Yield Trial

This small 16-entry trial was conducted to compare the performance of new white kidney compared to Chinook 2000 and Chinook Select light red kidney lines from MSU under supplemental irrigation. Yields ranged from 26 to 42 cwt/acre with a mean of 34 cwt/acre. Variability was moderate (CV=9.1%) resulting in a large LSD value (5.1 cwt/acre) needed for significance. Overall yields in this test were very high compared to previous years and top two lines exceeded 40 cwt/acre. Only two entries significantly outyielded the test mean and these included two new white kidney lines K04612 with large seed (66g), and K04605. Despite the long history of breeding red kidneys, the yield potential appears to exist in the white kidney class. Use will be made of the WK lines as parents to improve performance of the red kidney classes. The only check variety, Chinook 2000 yielded 32 cwt/acre and was 3 cwt/acre less than the reselected Chinook Select, K03601. K03601 was selected for increased root rot resistance and is being considered for release. Other entries in the test were white kidney lines, including one very tall entry K04614 that reached 60 cm. All entries will be canned prior to advance in 2005.

Expt. 4121: Preliminary Black Bean Yield Trial

This small 18-entry trial included new black bean breeding lines from the USDA-ARS program located at MSU where these lines are part of study to measure color retention in canned black beans. The lines were derived from cross of Black Magic/Raven as Black Magic retains good black after canning whereas Raven leaches out and exhibits extensive color loss during canning. Yields ranged from 10 to 22 cwt/acre with a mean for the test of 15 cwt/acre. Variability was not well controlled in

this 3-rep test (CV=12.3%) despite being direct harvested and the LSD was 3 cwt/acre. As a result only 4 lines significantly out-yielded the test mean and these included the T39 and Condor checks. The top yielding line B01112 had the highest desirability rating (6.0) in the test. Entries will be evaluated for canning quality and only those with canning quality equivalent to Condor will be advanced in 2005.

Expt. 4222: White Mold Variety Yield Trial

This 64-entry trial was conducted at Montcalm to evaluate a range of diverse dry bean varieties and breeding lines for reaction to white mold under natural field conditions. Genotypes included commercial navy and black bean cultivars, parents and lines from a recombinant inbred line (RIL) population of Bunsi/Raven where marker assisted selection was being practiced, IBL lines of wild bean PI 318695 backcrossed to Bunsi, elite MSU lines, and new sources of white mold resistance entered as part of the National *Sclerotinia* Bean Trial including the AN (Aztec/ND) pinto population. Lines in the National trial were developed at MSU, OSU, CSU, Cornell, NDSU and USDA-WA. Entries were planted in two row plots with two rows of susceptible spreader (variety mixture of Othello and Matterhorn) between plots. Supplemental overhead irrigation was applied 11 times for a total of 5" to maintain adequate levels of moisture for favorable disease development at the critical flowering period. Rainfall was very low in September, which reduced disease severity. Natural white mold infection occurred across the entire trial and was extremely severe in certain plots. White mold was rated on a per plot basis on a scale of 1 to 9 based on disease incidence and severity where 9 had 90+% incidence and high severity index. White mold ranged from 26% to 82%. The test ranged in yield from 24 to 45 cwt/acre with a mean yield of 33 cwt/acre. Variability was well controlled despite white mold pressure (CV=10.8%), yet a high LSD value (5.8 cwt/acre) was needed for significance. Despite the high disease pressure, seven lines significantly outyielded the test mean and these included 115-11M, one lines from the RIL population of Bunsi/Raven, Seahawk, Bunsi and Merlot and two sister lines from AN population. This is the fourth year that 115M has significantly outperformed all other entries suggesting that this material has genes that could be exploited for yield potential and white mold resistance. For the third year, a new pinto line AN37 from NDSU showed the low mold score but sister line AN-69 was lower in 2004. These two lines show potential to introduce improved levels of tolerance to white mold into the pinto and GN market classes. A few of the Bunsi BC lines showed potential and will be tested again in 2005. Among the best MSU lines was Seahawk navy (30% white mold), Merlot small red (44%), P02630 (56%) and P02647 pintos (52%), S00809 pink (46%), Condor black (52%), and G02453 GN (67%). GN varieties Matterhorn and Beryl did not escape mold in 2004 and the disease is reflected in the low yields (29 cwt/acre) and mold ratings from 63 to 81% as compared with high yield (36 cwt/acre) for Buster pinto despite high white mold rating (56%). The new small red line R97003 was also very susceptible to mold (70%). Overall the trial confirmed results from previous years and this trial will continue to be a vital part of the breeding effort to improve tolerance to white mold in dry beans.

Expt. 4223: White Mold Genetic Yield Trial

This 64-entry trial was conducted at Montcalm to evaluate the genetic resistance to white mold in two inbred backcross line (IBL) populations developed from the cross of Tacana*/PI 313850 and

Tacana*2/PI 318695. The two PI accessions have shown resistance to white mold in the greenhouse but do not flower under temperate long day conditions hence they cannot be field tested. PI 313850 is a landrace cultivar whereas PI 318695 is a wild accession. Twenty lines from each population with tolerance to white mold based on the straw test and 10 susceptible lines were planted for field evaluation. The test ranged in yield from 21 to 38 cwt/acre with a mean yield of 31 cwt/acre. Variability was well controlled despite white mold pressure and the adaptation of the lines (CV<10%), so LSD value (5 cwt/acre) was needed for significance. Five lines significantly outyielded the test mean, and included three lines with landrace parent and two from the wild bean parent. One line 8690 that ranked 5th ranked 3rd in test 3223 in 2003. None of the lines were significantly higher yielding than the Tacana parent or 115M (33 cwt/acre) but yields of fourteen lines were higher yielding in this trial despite the white mold. Within this group, line 8604 ranked 4th in 2003. These yields compared favorably with those in the white mold trial test 4222, which had more adapted advanced lines. Disease ratings ranged from 22 to 41% and were considerably lower than values for many of the current commercial varieties evaluated in test 4222. This test is essentially similar to test 3223 in 2003 but 23 lines were eliminated due to extreme late maturity and lack of adaptation. These data will be used along with 2003 data to conduct a genetic mapping experiment to find markers associated with white mold resistance in the landrace and wild bean PI accessions.

Expts. 4224 & 4225: Cranberry Drought Trials

Two 30-entry trials were conducted to determine the effect of drought on performance of recombinant inbred lines from the cranberry population C97407*2/NSL grown under stress and non-stress in drought prone soils in Montcalm in 2004. The study involved 26 $BC_2F_{4:7}$ IBLs developed by the inbred backcross method, plus checks and parents. The drought test (Expt. 4224) received no additional moisture other than natural rainfall, whereas the non-stress test (Expt. 4225) received 5 irrigations for an additional total of 2.75". The yield in test 4224 ranged from 14 to 25 cwt/acre with a mean of 20 cwt/acre. Variability was high (CV=19%) and LSD was 6.2. The yield in test 4225 ranged from 22 to 32 cwt/acre with a mean of 27 cwt/acre. Variability was moderate (CV=14%) and LSD was 6.2. The geometric mean between treatments was calculated and yields ranged from 17 to 27 cwt/acre with a mean of 23 cwt/acre. The top yielding entry was bush cranberry line C03121that exceeded yield of the drought tolerant black bean check B04647 (L66-83). The second line C03108 ranked 2nd in bush cranberry test 4213 and was the top yielder (31.5 cwt/acre) in test 4225 under no stress. The third cranberry line C03151 also ranked 3rd in the vine cranberry test 4112. The high LSD values prevented the identification of lines that were significantly higher yielding than the C97407 parent. A number of the cranberry lines showed considerable yield potential over both the parent and check variety and may be valuable germplasm for producers interested in growing cranberries under limited irrigation.

Expt. 4726: Regional Dry Bean Yield Trial, Presque Isle County

This 16-entry trial was conducted annually in grower's fields near Hawks by David Glenn (MSUE) with the primary focus of identifying different bean seed types with adaptation and potential for that northern region. Growing conditions were generally favorable in this region in 2004 with good

harvest conditions in the fall. Yields ranged from 15 to 23 cwt/acre with a mean yield of 18 cwt/acre. Variability was not well controlled (CV=13.9%) resulting in a high LSD value (3.5 cwt/acre) needed for significance. Only one line, Seahawk significantly out-yielded the test mean, which previously topped this trial in 2001 and 2003. The medium seed pinto, GN, small red and pink bean classes all out performed the smaller seeded black lines. The new black bean breeding lines B01741 and B00101 (Condor), which showed potential in this region in 2003 dropped to bottom of test just ahead of the kidney beans. The dry fall favored the earlier maturing medium-seeded classes over the full season black entries. The new pink line S00809 and the pinto line P02647, both of which performed well above the average, showed potential in this area. Montcalm, Redcoat and Red Hawk were among the lowest yielding entries. Despite the long and successful production of dark red kidney beans in this region, other seed types such as reds, pinks, pintos and GN are potential alternatives to the current kidney bean varieties.

Early Generation Breeding Material grown in Michigan in 2004

F3 through F5 lines

Navy and Black - 493 lines
Pinto - 95 lines
GN - 66 lines
Pinks and Reds - 48 lines
Kidneys (DR, LR, White)- 333 lines
Cranberry (bush, vine) - 348 lines
Tebo - 18 lines

F2 populations

Navy and Black -52 populations
Pinto - 58 populations
GN - 25 populations
Pinks and Reds - 89 populations
Kidneys (DR, LR, White) - 65 populations
Cranberry (bush, vine)- 68 populations