

Jose Fernandez Memorial Chair of Crop Production
Annual Report (July 1, 2013 – June 30, 2014)
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Onion Cultivar Development

Open-pollinated, male-sterile, maintainer, and pollinator breeding lines were screened for disease resistance, bulb yield, bulb quality, maturity date, and bulb color. Promising breeding and hybrid lines and released cultivars were compared to commercial cultivars and experimental lines using variety trials. Two cultivars, ‘NuMex Grandeur’ and ‘NuMex Whisper’, were released. ‘NuMex Grandeur’ is an open-pollinated, late-maturing, intermediate-day, cultivar with red-colored dry outer scales. It matures in late July to mid August when winter-sown in southern New Mexico. This cultivar will satisfy a need for a red onion cultivar that matures at this time. ‘NuMex Whisper’ is an open-pollinated, highly single-centered, late-maturing, intermediate-day cultivar with yellow-colored dry outer scales. It matures in mid June to early July when autumn-sown in southern New Mexico. Forty-six selections of different lines were conducted this year. Seeds of 221 different lines were produced this year.

Fusarium Basal Rot Research

With a high rate of disease development throughout the study, many of the selected populations did not perform well in terms of disease severity and incidence. Of the seven cultivar populations evaluated, all three generations of ‘NuMex Mesa’ exhibited a reduced severity and incidence as compared to the performance of both check cultivars. As the resistant cultivar, ‘Serrana’, is the standard for FBR resistance in short-day onion germplasm, the performance of ‘NuMex Mesa’ is encouraging for the development of a more FBR-resistant short-day cultivar. For both ‘NuMex Chaco’ and ‘NuMex Sweetpak’ cultivars, the first-selected generations performed better than their respective second generation populations. For these two cultivars, the initial selection was successful for reducing disease severity and incidence whereas a second selection was not. For ‘NuMex Crispy’, the original population and the second-selected generation exhibited a reduced disease severity and incidence when compared to the resistant or susceptible check cultivar. For ‘NuMex Camino’, ‘NuMex Luna’, and ‘NuMex Vado’, all three generations exhibited a similar severity and incidence as the check cultivars.

Our inoculation method was very effective at causing disease in most bulbs. Both the resistant and susceptible check entries exhibited a high level of disease severity and incidence and both entries could not be distinguished for both traits. These results suggest that the inoculation method needs to be modified to reduce infection rates and disease development in order to better differentiate between the resistant and susceptible check entries. A reduction in the incubation time period from 3 to 1 day after inoculation might be effective in achieving this aim.

Onion Thrips and Iris Yellow Spot Research

Germplasm was identified that possessed a reduced number of thrips per plant than most entries. Entries were identified that exhibited less severe IYS disease symptoms than most entries. Selection for reduced thrips number and IYS disease severity appears to be effective. Additional cycles of selection may be beneficial for increasing tolerance to thrips and/or IYS.

Eighty-eight onion breeding lines selected for reduced Iris yellow spot (IYS) disease symptom expression, 7 plant introduction (PI) accessions from the U.S. germplasm collection, 8

experimental breeding lines from the New Mexico State University (NMSU) breeding program, and 3 commercial cultivars were evaluated for the number of thrips per plant and IYS disease symptoms. Adult and juvenile onion thrips number per plant was highest at 13 and 16 weeks post transplanting. Among those breeding lines selected for reduced IYS symptom expression, plants of 33, 37, and 25 lines possessed fewer thrips at 10, 13, and 16 weeks after transplanting, respectively, than plants of the susceptible checks, 'Rumba' and 'Vaquero'. For those lines that were selected from PI 172703, plants of seven second generation lines had fewer thrips than plants of PI 172703 when thrips were counted at 10 weeks. At 13 weeks, plants of nine second generation lines had fewer thrips per plants than plants of PI 172703. For those lines that were selected from PI 546140, plants of NMSU 12-295 had fewer thrips than plants of PI 546140 when thrips were counted at 10 weeks.

Among those breeding lines selected for reduced IYS symptom expression, plants of 13 lines exhibited less severe IYS disease symptoms than plants of the susceptible checks, 'Rumba' and 'Vaquero' at 13 and 16 weeks after transplanting. At 13 and 16 weeks, plants of second generation lines, NMSU 12-335, and 12-342, exhibited less severe disease symptoms than plants of their parental lines, NMSU 07-32-2 and 07-56-2, respectively. At 13 weeks, plants of NMSU 12-236 exhibited a lower disease severity than plants of its parental line, NMSU 07-52-1. At 16 weeks, plants of second generation lines, NMSU 12-239 and 12-243, exhibited less severe disease symptoms than plants of their parental line, NMSU 07-53-1. In addition, plants of NMSU 12-285 exhibited less severe disease symptoms than plants of its parental lines, PI 289689. At 19 weeks, plants of NMSU 12-335 and 12-243 exhibited less severe disease symptoms than plants of their parental lines, NMSU 07-32-2 and 07-53-1.

Eleven selected lines exhibited a lower IYS disease incidence than the susceptible checks, 'Rumba' and 'Vaquero' at 13 weeks after transplanting. Selected lines, NMSU 12-236 and 12-335, exhibited a lower disease incidence percentage than their parental lines, NMSU 07-52-1 and 07-32-2, respectively. By 16 weeks, disease incidence had reached 100% for all entries. Seeds of 76 different lines were produced in this year.

Onion Germplasm Regeneration and Maintenance

On February 27, 2014, seed of 13 plant introduction accessions (172702, 172703, 239633, 264320, 271039, 288909, 289689, 537590, 546106, 546140, 546188, 639911) and 10 collected germplasm lines (Agrifound Light Red, Agrifound Dark Red, Agrifound Rose, Bombay White, Poona Red, Rio Jefe, Samaru Composite, Siohu PBR-2, Tancepa Hazar, White Tampico) was sent from the onion breeding program at NMSU to the onion curator at the PGRU in Geneva, NY. Regeneration attempts of 18 PI accessions and six germplasm lines were in progress during this year. Additional funds were added to the specific cooperator agreement to continue our seed regeneration efforts for the USDA.

Outreach

Presentations regarding the breeding work being done by the NMSU onion breeding program were made to the New Mexico Dry Onion Commission on March 18, 2014 and May 22, 2014.

Breeding for resistance to Iris yellow spot. 2013 Annual Meeting of the Pacific Northwest Vegetable Association in Pasco, WA on November 13, 2013

On July 16, 2013, a field day was held to demonstrate the activities of the New Mexico State University onion breeding program. A presentation was given on the work being conducted

to develop thrips and Iris yellow spot resistant cultivars. Another presentation was given on the work being conducted to develop FBR-resistant cultivars.

Other

Our program hired two minority undergraduate students, one a horticulture major and another a genetics majors, to work as interns for our program. I was on sabbatical leave from July 1, 2013 until November 30, 2013. I used this time to visit various university and commercial research programs throughout the U.S. In order to improve the efficiency of our breeding program, funds from the memorial chair were used to purchase a small plot vacuum seeder that eliminated the need for hand planting of seeds.

Publications

Refereed

Cramer, C.S. 2014. 'NuMex Grandeur' onion. HortScience 49:350-353.

Saxena, A. and C.S. Cramer. 2013. Metabolomics: A potential tool for breeding nutraceutical vegetables. Adv. Crop Sci. Tech. 1:106. doi:[10.4172/ acst.1000106](https://doi.org/10.4172/acst.1000106).

Abstracts

Cramer, C.S. and N. Kamal. 2013. Measuring selection progress in onion germplasm after one selection cycle for reduced Iris yellow spot symptom expression. HortScience 48:S363. (Abstr.)

Cramer, C.S. and N. Kamal. 2013. Selection progress for reduced Iris yellow spot symptom expression in onion germplasm after one selection cycle. 2013 Joint Annual Meeting of the Plant Breeding Coordinating Committee and National Association of Plant Breeders. June 2-5, 2013. Tampa, FL. p. 26.

Singh, N. and C.S. Cramer. 2013. Selection progress for reduced Iris yellow spot symptom expression in onion. HortScience 48:S364. (Abstr.)

Other

Bartolo, M.E., C.S. Cramer, and D. Drost. 2013. Planting and post-planting, pp. 15-17. In: Onion Health Management and Production. H.F. Schwartz (Ed.), Colorado State Univ., Fort Collins, CO, 104 pp.

Bartolo, M.E., C.S. Cramer, and D. Drost. 2013. Other cultural practices, p. 18. In: Onion Health Management and Production. H.F. Schwartz (Ed.), Colorado State Univ., Fort Collins, CO, 104 pp.

Bartolo, M.E., C.S. Cramer, and D. Drost. 2013. Harvest and post-harvest procedures, pp. 22-24. In: Onion Health Management and Production. H.F. Schwartz (Ed.), Colorado State Univ., Fort Collins, CO, 104 pp.

Cramer, C.S. 2013. 'NuMex Grandeur' onion. NM Agric. Expt. Stn. Rel. Not., 21 pp.

Cramer, C.S. 2013. 'NuMex Whisper' onion. NM Agric. Expt. Stn. Rel. Not., 29 pp.

Cramer, C.S. and M.E. Bartolo. 2013. Varietal reviews, pp. 12-14. In: Onion Health Management and Production. H.F. Schwartz (Ed.), Colorado State Univ., Fort Collins, CO, 104 pp.

Presentations

Breeding for resistance to Iris yellow spot. 2013 Annual Meeting of W2008: Biology and Management of *Iris yellow spot virus* (IYSV), Other Diseases and Thrips in Onions in Denver, CO on December 12, 2013.

The following presentations were made at the 2013 Annual Conference of the American Society for Horticultural Science in Palm Desert, CA on July 22-25, 2013: Measuring selection progress in onion germplasm after one selection cycle for reduced Iris yellow spot symptom expression; and Selection progress for reduced Iris yellow spot symptom expression in onion.

The following presentations on were made at the joint meeting of the Hazera Genetics and Nickerson-Zwaan Onion Research Teams in Visalia, CA on July 30, 2013: Breeding for resistance to FBR and pink root; Breeding for resistance to Iris yellow spot in onion; Breeding for single centers; and NMSU onion breeding program.

Utilization of Memorial Chair Funds

\$16,374.97 towards salary enhancement and fringe benefits of chair holder.

\$9,010.73 towards undergraduate student salaries and fringe benefits.

\$3,161.71 towards conference travel and attendance of the chair holder and travel associated with sabbatical leave.

\$2,841.50 towards the purchase of a vacuum seeder.

Plans for Coming Year

Selections and seed production will continue towards the development of adapted onion cultivars. Another intermediate-day, red cultivar is planned for release. Fusarium basal rot research will continue with a second year of evaluation for selected material. In addition, seed will be produced of selected populations. Developed populations will be evaluated for their onion thrips and Iris yellow spot tolerance. In addition, seed will be produced of selected populations. Seed production of onion plant introduction accessions will continue with the establishment of a new 5 year specific cooperator agreement. A field day will be held to demonstrate the activities of the breeding program. The two undergraduate interns will continue working for the program. One intern will initiate a research project examining the effects of nepatalactone on the activity of onion thrips on onions. In an effort to further improve the efficiency of our breeding program, funds from the memorial chair will be used to purchase crossing cage fabric and the fabrication of crossing cage covers that require less maintenance and have a greater lifespan than currently used fabric.