related seedlings, in that way you can be sure because no person wants to wait twenty years and then find out that the union is not compatible.

HUMPHREY: Quite. We do in fact use some form of guide, we use Rehder's Manual of Trees and Shrubs as an initial indication don't we? We really base our combinations on botanical characteristics and work it from there, it saves a certain amount of hunting anyway doesn't it?

DUMMER: It does, yes, but of course it is not always right.

Sometimes with things like Azaleas for instance, one should not worry too much, if one can get a union for a while and plant deeply enough, the scion will eventually form roots. In other words, carry out nurse grafting.

HUMPHREY: Well, I think, Pete, our time must be up by now, we have had a very pleasant evening sitting here together looking at these pictures and we hope very much that the tape reaches you over there on time and that the slides reach you as well and the projectionist is clever enough as I am sure he will be, to match the two together. We wish you all every success for a really good meeting.

Goodbye to you all.

MODERATOR SHUGERT: Our second paper on rootstocks is being presented by a gentleman who has also traveled a good distance to be with us. He is president of the Western Region of the International Plant Propagators' Society and his topic is "Bloom Production on Selected Garden Rose Rootstocks." It is my pleasure to introduce Bob Ticknor.

BLOOM PRODUCTION ON SELECTED GARDEN ROSE ROOTSTOCKS

R. L. TICKNOR AND A. N. ROBERTS
Oregon State University
Corvallis, Oregon

Introduction

Nursery performance of sixteen rose rootstocks budded with five scion varieties, Etoile de Holland, Lowell Thomas, Picture, Pres. Hoover and White Prince, were reported at the Western Region meeting in 1963 (2). The majority of the rootstocks rooted well with the exception of O. S. U. 1 and 8, P.&D. 5214 and 5360, and Dr. Huey. On a comparative basis, five of the rootstocks, D-1, Ginn, P.&D. 5222 and 5234, and Van, proved to be outsanding for bud stand with the five scion varieties used in this trial. Four other rootstock-scion combinations were outstanding, O. S. U. 1 and Burr with Pres. Hoover, Burr with Etoile de Holland, and 5250 with Picture.

Materials and Methods

Since producing rose bushes in the nursery is only the first part of the use of this plant, garden trials were initiated to answer questions on length of life, vigor, transplantability and bloom production of the most successful scion-rootstock combinations. Trials were planted at Oregon State University's North Willamette Experiment Station, Aurora, and Lewis-Brown Horticulture Farm, Corvallis, in November, 1962. Six plants of each scion-rootstock combination which survived the nursery trial were planted at both of these locations.

In addition, selected scion-rootstock combinations were sent to Iowa; Long Island, New York; and Minnesota; but because of drought and fire information was received only from Minnesota. The first year results at Aurora, Corvallis and Minnesota were reported by Ticknor, et. al. (3).

Bloom records were recorded periodically for each individual plant throughout the season for three years at Corvallis and for four years at Aurora. Lowell Thomas and Pres. Hoover did not establish well on all rootstocks. Many plants were lost the first season, particularly on the D-1 and Ginn rootstocks. Desiccation of the plants at the time these scion varieties were dug appears to be the reason for these losses.

Notes were taken on suckering of the different rootstocks, although suckering was not a major problem with any of the rootstocks.

Results and Discussion

The bloom production results of the five scion varieties on the 11 or 12 stocks are presented in Tables 1 to 5. Statistical analysis was done for each variety to establish an L. S. D. (least significant difference) so that bloom production significantly better than the average for the variety could be indicated.

It was found that bloom production was influenced by several factors: scion variety, rootstock variety, location, and number of years the plants have been growing in a location. Lowell Thomas and White Prince had lower average bloom production per plant than the other scion varieties. The rootstock variety exerts a strong influence on the performance of the scion variety. From observation this effect is more pronounced on weak growing scion varieties which tend to be more specific in rootstock requirements than do strong growing scion varieties. Location had an influence on bloom production in this trial. Soil type was the major difference between the locations 65 miles apart which have very similar climates. Bloom production was higher in the well drained sandy loam soil at Aurora than in the clay at Corvallis. The first year in the garden is a year of establishment with low bloom production. Bloom production on some stocks improves with time such as Vandermoss budded with Pres. Hoover which produced only 28 blooms the first year but produced

396 blooms, the highest in the trial, the third year. In contrast, Welch produced a statistically significant 108 blooms the first year when budded with Pres. Hoover but produced only 147 blooms the third year. This latter number is significantly below average for bloom production for that year and variety.

Some comments about the bloom production and adaptibility of the different stocks are as follows:

OSU 1: Good only with White Prince but poor with Lowell Thomas and Picture at Aurora and average at Corvallis.

OSU 6: Good with Pres. Hoover and White Prince but poor with Etoile de Holland, Lowell Thomas and Picture. No suckers.

Vandermoss: A variable rootstock good with White Prince at both locations. Good with Lowell Thomas and Pres. Hoover at Aurora but poor with Etoile de Holland and Picture. At Corvallis it was either poor or average with the latter four varieties. Possibly better adapted to light soils.

P.&D. 5222: A good stock with Etoile de Holland, Lowell Thomas and Picture but poor with Pres. Hoover and White Prince. A thorny stock. No suckers.

P.&D. 5234: A good stock for Lowell Thomas and Picture but poor with White Prince. A thorny stock.

P.&D. 5350: Rather an average stock, really only good with White Prince at Aurora. A thorny stock.

Brooks: Probably the best stock in the garden trial. But stand with Etoile de Holland was so poor that plants were not available for garden trial.

Ginn: Generally a good stock except with White Prince. Also gave poor nursery results with this scion variety. More prone to suckering than any other stock in trial.

Welch: Generally a good stock the first two years but does not seem to hold up. Has been dropped by Oregon growers because of winter injury problems.

D-1: Poor bloom production except with Etoile de Holland the first two years. Looked good in nursery trials. No suckers.

Burr: Generally a good stock but appears better adapted to lighter than heavy soils. Most widely used rootstock in Oregon at present. Also used in northern California.

Dr. Huey: Consistently poor under our conditions. Possibly better adapted to the warner soils found in the southwest.

A wide variety of rootstocks, most of which were not maintained as clones, were in use in Oregon when Roberts started rose rootstock trials at Oregon State University in 1948. One of the objectives of these trials was to find a single rootstock which would give superior performance in both the nursery and the garden. While this objective has not been completely achieved since several rootstocks are in use today . In practice the growers in Oregon, Texas and the Northwest use multiflora stocks while those in Arizona and Southern California use Dr. Huey. At present, most roses produced in Oregon are grown on the Burr strain of *R. multiflora;* thus while we do not have a universal stock, in practice in the Northwest we almost have one.

Up to 1964, a considerable number of roses were also grown on the Welch strain in Oregon. In that year, the temperature dropped to 6° F. in December, damaging the stems of Welch so they could not be used for cuttings. The one grower who was using Burr at that time supplied wood for cuttings to the other growers that year.

Work by Furuta (1) supported by leaf samples from our Oregon trials has given a possible explanation for the use of Dr. Huey in southern California and *R. multiflora* in the northwest. Leaf analysis shows that plants growing on the same soil will have higher boron content on *R. multiflora.* In areas where boron approaches toxic levels Dr. Huey is the better stock, but where boron is often deficient *R. multiflora* is the better stock. In addition, Dr. Huey is quite subject to mildew in Oregon and does not produce good wood for propagation.

Average Bloom Production Per Plant of Etoile de Holland Roses on Several Rootstocks at two locations

	Aurora				Corvallis		
	1963	1964	1965	1966	1963	1964	1965
OSU 1	99	140	167	162	79	140	116
OSU 6	87	105	133	141	85	96	89
Vandermoss	94	112	141	153	60	66	75
5222 P&D	74	146	202**	199	103**	147*	120
5234 P&D	125**	155	173	210**	87	133	112
5350 P&D	92	158	172	189	74	128	134
Ginn 58-L-2	106	195**	185**	236**	80	192**	165**
Welch	96	146	135	171	108**	188**	146**
D-1	123**	184**	160	163	79	124	134
Dr. Huey	81	135	112	178	65	87	73
Burr	90	161	163	204**	67	111	122
Average	97.0	148.8	158.4	182.3	80.6	128.2	116.9
LSD 5%	14.8						
LSD 1%	21.1						

Average Bloom Production Per Plant of Lowell Thomas Roses
on Several Rootstocks at Two Locations

	Aurora				Corvallis		
	1963	1964	1965	1966	1963	1964	1965
OSU 1	37	49	41	97	26	57	58
OSU 6	27	51	77	131	30	55	55
Vandermoss	44	73	108**	165**	30	50	52
5222 P&D	50	69	75	120	30	77*	132**
5234 P&D	48	106**	91*	128	30	85**	70
5350 P&D	32	55	79	129	36	63	59
Brooks-48	92**	129**	106**	194**	32	60	68
Ginn 58-L-2	48	63	46	60	42	83**	82**
Welch	94**	78*	70	124	55**	107**	62
D-1	49	56	105**	85	25	30	28
Dr. Huey	34	43	38	96	23	42	38
Burr	39	27	73	135*	36	76	74
Average	49.5	66.6	75.8	122.0	32.9	65.4	64.8
LSD 5%	11.4						
LSD 1%	16.1						

Average Bloom Production per Plant of Picture Roses
on Several Roostocks at Two Locations

	Aurora				Corvallis		
	1963	1964	1965	1966	1963	1964	1965
OSU 1	63	133	100	131	66	143	180
OSU 6	62	110	127	122	61	121	147
Vandermoss	66	137	114	112	51	110	111
5222 P&D	86	149	141	171	66	162**	220**
5234 P&D	60	155	162*	202**	64	150**	198**
5350 P&D	100**	169**	155	151	70	141	179
Brooks-48	104**	158	180**	206**	83**	175**	258**
Ginn 58-L-2	80	170**	180**	197**	48	110	196**
Welch	108**	172**	162*	174	72*	127	141
D-1	66	117	119	133	42	101	150
Dr. Huey	66	123	128	152	30	99	133
Burr	121**	198**	178**	234**	66	164**	21
Average	81.8	149.2	145.9	165.4	59.9	133.6	177.0
LSD 5%	11.6						
LSD 1%	16.3						

Average Bloom Production Per Plant of President Hoover Roses on Several Rootstocks at Two Locations

	Aurora				Corvallis		
	1963	1964	1965	1966	1963	1964	1965
OSU 1	75	133	205	276	67	111	107
OSU 6	79	158	262**	295*	66	164*	110
Vandermoss	28	196*	396**	389**	16	66	141
5222 P&D	57	107	108	160	44	129	124
5234 P&D	66	166	207	246	48	148	129
5350 P&D	66	120	178	227	46	130	141
Brooks-48	38	93	182	301*	80	122	115
Ginn	91	270**	188	275	45	110	128
Welch	108*	131	147	203	83	144	118
Dr. Huey	67	125	120	168	48	67	80
Burr	27	77	280**	247	93	154	164*
Average	63.8	143.2	206.6	253.3	57.8	122.2	123.3
LSD 5%	37.5						
LSD 1%	53.4						

Average Bloom Production Per Plant of White Prince Roses on Several Rootstocks at Two Locations

	Aurora				Corvallis		
	1963	1964	1965	1966	1963	1964	1965
OSU 1	77**	67	87	191**	47*	68*	69
OSU 6	68	79**	106**	191**	41	87**	85**
Vandermoss	64	62	93*	165*	33	64	81**
5222 P&D	25	68	60	113	24	44	34
5234 P&D	49	52	68	126	38	47	54
5350 P&D	70*	51	93*	215**	33	61	65
Brooks-48	77**	64	106**	223**	43	102**	93**
Ginn 58-L-2	52	68	85	105	32	31	47
Welch	69	59	96**	118	43	49	79**
D-1	47	39	48	75	32	47	38
Dr. Huey	60	43	58	121	35	29	34
Burr	68	55	83	180**	31	64	71
Average	60.5	58.9	81.9	151.9	36.0	57.8	62.5
LSD 5%	9.3						
LSD 1%	13.1						

LITERATURE CITED

1. Furuta, T 1966. Personal Communications
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MODERATOR SHUGERT: Thank you very much Bob for a very interesting and thorough paper. The next paper will also be presented by a member of the Western Region. The paper is on the "Morphology of Arizona Cypress on Hetz Juniper." It has been written by Dr. Fred Widmoyer and Dr. Darrell Sullivan. The paper will be presented by Darrell Sullivan.

MORPHOLOGY OF ARIZONA CYPRESS ON HETZ JUNIPER

FRED B. WIDMOYER AND DARRELL T. SULLIVAN
New Mexico State University
Las Cruces, New Mexico

For the past several years there has been an increase in the number of papers discussing the relationships of stocks and scions of ornamental plants. The basic phenomena occurring during the re-establishment of graft's were presented at the 12th Annual Meeting (Widmoyer, 1962). Snyder (1963) pointed out that the major areas of propagation research of ornamental plants are consentrated on the rooting of cuttings and germination of seeds. Budding and grafting have received the major attention for fruit crops. As a result of continued research and experience, the use of vegetatively propagated rootstocks has become standard practice (Fletcher, 1964). Most propagators recognize the value of graftage over seedage or cuttings as a technique, as well as the associated disadvantages.

In selecting a stock for any plant, choice is limited to those which have a close botanical relationship. Generally, seedlings of the species are chosen as the scion. Grafts between genera are not unusual, but as a general rule, are limited to relatively few plants. Some ornamental plants which may serve as examples are: *Syringa* (lilac) on *Ligustrum vulgare* (privet); *Cotoneaster* on *Crataegus* (hawthorne); *Chaenomeles* (flowering quince) on *Sorbus* (mountain ash); and *Pyrus* (pear) and *Malus* (apple) on *Crataegus oxyacantha.* Notice particularly the absence of the narrow-leafed evergreens.

Several years ago the cutting-graft procedure was described. This technique was especially valuable when the potted stocks were not on hand at the proper season. To be of the greatest use, the stock-scion must form a quick union. The stock must root readily. The stocks need to be slightly larger than for cuttings to facilitate handling. Healing of the wound is necessary for a successful graft. This process is accomplished by the action, principally, of the cambium layer. Any other