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The Balled-and-Burlapped Pack For Ornamental Shrubs and Trees

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WEST VIRGINIA UNIVERSITY
AGRICULTURAL EXPERIMENT STATION
COLLEGE OF AGRICULTURE, FORESTRY, AND HOME ECONOMICS
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Summary

IN 1956-57, at West Virginia's largest nursery, measurements were made to discover the ratio of soil weight to total weight among three popular kinds of shrubs marketed in the balled-and-burlapped pack. The grade chosen for study was that specifying a 15- to 18-inch crown diameter. The plants selected were Japanese holly, Pfitzer juniper, and evergreen azalea, the last to represent the shallow-rooted species. Each plant was weighed. Then the soil was washed gently from the roots, the plant shaken dry and reweighed. It was found that soil weights comprised approximately 90 per cent of the total weight. Thus, B&B packs not only remove some of the topsoil from nurseries but also may cause a direct or indirect penalty amounting to nine-tenths of shipping costs. In a competitive market, buyers who assume shipping costs may insist on a corresponding price reduction or purchase near-at-home.

The soil balls of more than 500 B&B plants were measured by water displacement in order to obtain an indication of the rate of soil removal. Results indicated that an acre of soil one foot deep is removed in 50 to 100 years by 18- to 24-inch holly, 18- to 24-inch juniper, and 3- to 4-foot dogwood, spaced and dug at various intervals. At the same spacing and digging intervals, 15- to 18-inch holly and juniper remove an acre-foot of soil in 60 to 130 years. Azaleas remove less soil than the rather deeply rooted shrubs. In the 18-inch grade and at the spacing and digging intervals selected, azaleas remove an acre-foot of soil in from 70 to 150 years; in the 15-inch grade they remove an acre-foot in from 110 to 240 years. These results indicate that the rate of soil removal customarily attributed to the B&B pack may be excessive. Some factors which might cause more rapid soil depletion than this study indicates are: clean tillage, soil compacted by excessive overhead irrigation, and inadequate maintenance of the soil-humus relationship.

Records were kept of the time spent in balling and burlapping regular orders for more than 1,000 holly, juniper, dogwood, and azalea plants. These records showed that from 1.7 to 21 minutes of a man's time had been consumed in digging and burlapping a plant. The average time was 8.6 man-minutes. There was no apparent relationship between the grade or kind of plant and the man-minutes of labor involved. No notes were kept of weather or soil conditions. A field foreman usually was present during digging and burlapping operations.

A second set of records was taken while orders were filled under conditions which offered the men a voluntary incentive for speed. The men were told that the West Virginia University Experiment Station

wanted to find out what a good man could do. The nursery manager made the records and noted weather and soil conditions. He also included the time spent in dropping sacks, tying crowns, and carrying plants to the nearest nursery road. Man-minutes per plant ranged only from 3.0 to 5.0 and averaged 3.8. The crew of workers soon had developed a spirit of friendly competition and an unofficial "champion" had been recognized as such. The nursery manager reported that the quality of burlapping and balling had not suffered from the competitive nature of the work.

Notes on weather and soil conditions indicated that a combination of foggy, wet weather and muddy soil slowed operations appreciably: that air temperatures ranging from 44 to 51° F. had no apparent effect; and that foggy, wet weather alone, or wet soil alone, had only a slight effect on the speed of balling and burlapping.

The Balled-and-Burlapped Pack For Ornamental Shrubs and Trees

ROGER W. PEASE

Introduction

IN 1956-57 the West Virginia University Agricultural Experiment Station gathered data concerning the B&B (balled-and-burlapped) method of packaging ornamental shrubs and trees. The objectives were three-fold: to obtain an indication of the relationship between soil weight and total weight among balled-and-burlapped plants, to measure the soil losses incurred,¹ and to analyze labor practices and labor time involved in packaging the plants.

Proportionate Weight of Soil in B&B Stock

Evergreen shrubs were chosen for study because they comprise most of the plant sales made by West Virginia's commercial nurserymen.² Three classes were selected: Japanese holly, as representative of the broad-leaved evergreens with normally-deep root systems; Pfitzer junipers, as representative of the narrow-leaved evergreens, also with normally-deep root systems; and evergreen azaleas, as representative of the broad-leaved evergreens with shallow root systems. The American Association of Nurserymen's grade of shrub specifying a crown diameter of at least 18 inches was selected because this is one of the most popular sizes marketed in the State. The study was made at West Virginia's largest nursery, where an adequate selection of plants was available.

The plants were selected at random from different graded lots ready for shipment from the packing shed. Each plant, with its balled-and-burlapped root system, was weighed. Then the burlap was removed, and the root system was washed clean with the aid of a garden hose. The clean plant materials were shaken dry. The weight of plant material

¹Calculations have been made concerning the volume of soil removed by marketing B&B stock: *Soil Losses in Nursery Practice*, undated report prepared on the basis of cylindrically-shaped balls of soil, Bettes, Russell M., N. J. Dept. Ag.; 1956 resume of calculations made on the basis of spherically-shaped balls of soil, out-of-print, Chadwick, L. C., Dept. Hort., Ohio State U., Columbus, Ohio.

²See *The Marketing of Ornamental Shrubs and Trees by West Virginia's Full-Time Nurseries*, Pease, Roger W., W. Va. Univ. Ag. Exp. Sta. Bull. 417, 1958.

plus the average weight of the burlap wrappings were subtracted from the total weight of each plant in order to obtain the weight of soil. This process ruined the plants studied, and the plant classes in the grade chosen were relatively expensive. Therefore, only ten plants in each class were processed.

Table 1 shows the proportionate weight of soil in relation to the total weight within each class. Relatively less soil was included in packs of the shallow-rooted evergreen azaleas than in packs of the more deeply-rooted hollies and junipers; and the azaleas weighed less than half as much as the deeper-rooted plants. The proportionate soil weight per plant ranged from about 90 to about 94 per cent among the hollies, from about +94 to 97 per cent among the junipers, and from about +86 to about 97 per cent among the azaleas. Thus there was more variation among shallow-rooted plants than among the deeper-rooted plants. The few cases involved make precise conclusions unwarranted. Yet the Table indicates that in shipments of the most popular evergreen shrubs, soil weight comprises at least 90 per cent of the total weight. Under conditions where freight rates are affected by weight and distance, this high percentage of soil weight penalizes those growers who market B&B plants in comparatively distant localities. Even if the buyers finance transportation, the growers are placed at a disadvantage proportionate to the distance and to the weight of the soil shipped because, in a competitive market and under the circumstances outlined, many buyers might prefer to purchase near-at-home.

Soil Losses Incurred by Packaging B&B

A total of 550 balled-and-burlapped plants was studied to determine soil losses involved. Two grades with minimum crown diameters of 15 and 18 inches, respectively, were selected in each of the three classes

TABLE 1. THE PROPORTIONATE WEIGHT OF SOIL TO TOTAL WEIGHT, THE RANGE OF PER-PLANT WEIGHT, AND THE TYPE OF ROOT SYSTEMS AMONG VARIOUS EVERGREEN SHRUBS PACKED B&B, 1956.

CLASS AND GRADE OF PLANT	PLANTS	AVERAGE WEIGHT OF B&B PLANTS	PROPORTION- ATE WEIGHT OF SOIL	RANGE OF PER-PLANT WEIGHT	TYPE OF ROOT SYSTEM
	<i>Number</i>	<i>Pounds</i>	<i>Per cent</i>		
Japanese Holly, 18-24" Crown	10	52.8	90.6	90.6-94.1	Relatively Deep
Pfitzer Juniper, 18-24" Crown	10	50.3	95.9	94.0-97.1	Relatively Deep
Evergreen Azalea, 18" Crown	10	22.1	90.1	86.4-96.9	Shallow

previously studied. A grade of dogwood with a minimum height of 3 feet also was selected in order to study deciduous plants in a popular size and class.

Figures 1, 2, 3, and 4 illustrate the method used to measure soil-ball volumes by water displacement. In Figure 1 the ball of soil, with burlap intact, is being wrapped with water-proof plastic, preparatory to placing the plant in the metal tank; in Figure 2 water has been added until the soil ball has been submerged to the previous ground level, and the gauge in the tank is being set; in Figure 3 the plant has been removed from the water and is draining while it rests on a metal stand above the tank; in Figure 4 water is being added to the tank from a cylinder graduated in cubic centimeters. After the water level had returned to the previously set gauge, the number of cubic centimeters added was recorded. No allowance was made for the volume of burlap or plastic, but care was taken to avoid air pockets in the wrapped plastic.

Root volumes for ten plants in each of the three evergreen classes were measured³ by water displacement. Expressed as a proportion of the average ball volume, the average root volume was 2.8 per cent in the case of 18- to 24-inch Japanese hollies, 2.5 per cent in the case of 18- to 24-inch junipers, and 3.4 per cent in the case of 18-inch azaleas. These root volume proportions were used throughout the study of soil losses. Dogwoods had not been available for the study of proportionate soil weights. Both dogwoods and junipers customarily are sheared lightly, and thus they are less mature as a given grade than are holly and taxus. Therefore, the 2.5 per cent root-to-ball relationship of junipers was assigned arbitrarily to dogwoods.

Table 2 shows the number of plants, the average ball volume, the proportionate root volume, and the calculated soil volume for each of the classes and grades of the plants measured. The 3- to 4-foot dogwoods and the 18- to 24-inch junipers and hollies removed approximately the same volume of soil per plant. The hollies and junipers in the 15- to 18-inch grade also removed about the same amount of soil per plant. However, in both grades, the shallow-rooted azaleas removed much less soil than did any of the other plant classes.

Column four of Table 3 shows the uniformity of soil-ball size within each class and grade in contrast to the lack of uniformity among all plants irrespective of class and grade. The uniformity within classes and grades (except in the case of 15-inch azaleas) was approximately twice as great as was the uniformity among all plants irrespective of class and grade.

³These measurements had been made during the study of proportionate soil weight among B&B plants.

1. Wrapping soil ball with plastic.

2. Setting gauge at water level.

3. Draining water into tank.

4. Raising water level back to gauge.

TABLE 2. THE AVERAGE VOLUME OF BALL, THE PROPORTIONATE VOLUME OF ROOTS TO SOIL, AND THE VOLUME OF SOIL AMONG ORNAMENTAL PLANTS PACKED B&B, 1956.

CLASS AND GRADE OF PLANT	PLANTS	AVERAGE BALL VOLUME	PROPORTIONATE ROOT VOLUME	SOIL VOLUME IN AVERAGE BALL
	<i>Number</i>	<i>Cu. Feet</i>	<i>Per cent</i>	<i>Cu. Feet</i>
Japanese Holly, 18-24" Crowns	100	.63	2.82	.61
Pfitzer Juniper, 18-24" Crowns	100	.63	2.46	.61
Evergreen Azalea, 18" Crowns	50	.45	3.39	.43
Dogwood, 3-4' Height	50	.62	2.46	.60
Japanese Holly, 15-18" Crowns	100	.49	2.82	.48
Pfitzer Juniper, 15-18" Crowns	100	.48	2.46	.47
Evergreen Azalea, 15" Crowns	50	.27	3.39	.27

TABLE 3. THE VARIATION IN BALL VOLUME OF 550 ORNAMENTAL PLANTS PACKED B&B, AS MEASURED BY COEFFICIENTS OF VARIABILITY, 1956.

CLASS AND GRADE OF PLANT	PLANTS	AVERAGE BALL VOLUME	STANDARD DEVIATION*	COEFFICIENT OF VARIABILITY**
	<i>Number</i>	<i>Cu. Feet</i>	<i>Cu. Feet</i>	<i>Per cent</i>
Japanese Holly, 18-24" Crowns	100	.63	.07	12.09
Pfitzer Juniper, 18-24" Crowns	100	.63	.08	12.59
Evergreen Azalea, 18" Crowns	50	.45	.06	12.98
Dogwood, 3-4' Height	50	.62	.08	13.29
Japanese Holly, 15-18" Crowns	100	.49	.05	10.19
Pfitzer Juniper, 15-18" Crowns	100	.48	.06	12.81
Evergreen Azalea, 15" Crowns	50	.27	.05	17.70
All Plants Irrespective of class	550	.53	.13	24.10

*A range of one standard deviation over and under the average will include 68.27 per cent of the cases.

**Standard deviation divided by the average, expressed as a percentage.

Table 4 shows the approximate number of plants of each class and grade which would have removed one acre-foot of soil. About 13 shallow-rooted azaleas and eight deeper-rooted plants removed the same amount of top soil.

Table 5 shows the number of crops of each class and grade which would have removed one acre-foot of soil if the plantings had been made

TABLE 4. THE ESTIMATED NUMBER OF VARIOUS ORNAMENTAL PLANTS REQUIRED TO REMOVE ONE ACRE-FOOT* OF SOIL, IF MARKETED B&B, 1956.

CLASS AND GRADE OF PLANT	PLANTS TO REMOVE ONE ACRE-FOOT OF SOIL
Japanese Holly, 18-24" Crowns	70,960
Pfitzer Juniper, 18-24" Crowns	70,830
Evergreen Azalea, 18" Crowns	101,280
Dogwood, 3-4' Height	72,270
Japanese Holly, 15-18" Crowns	90,660
Pfitzer Juniper, 15-18" Crowns	92,880
Evergreen Azalea, 15" Crowns	163,820

*The volume of soil which would cover an acre of land to a depth of one foot.

TABLE 5. THE ESTIMATED NUMBER OF VARIOUS ORNAMENTAL CROPS* WHICH WILL REMOVE ONE ACRE-FOOT OF SOIL IF MARKETED B&B, 1956.

CLASS AND GRADE OF PLANT	CROPS TO REMOVE ONE ACRE-FOOT OF SOIL		
	PLANT SPACING (INCHES)		
	36 x 42	30 x 42	24 x 42
	<i>Number</i>	<i>Number</i>	<i>Number</i>
Japanese Holly, 18-24" Crowns	17	14	11
Pfitzer Juniper, 18-24" Crowns	17	14	11
Evergreen Azalea, 18" Crowns	24	20	16
Dogwood, 3-4' Height	17	15	12
Japanese Holly, 15-18" Crowns	22	18	15
Pfitzer Juniper, 15-18" Crowns	22	19	15
Evergreen Azalea, 15" Crowns	40	33	26

*A crop, in this case, indicates one complete planting of ornamentals, marketed B&B.

at various spacings. However, it takes at least four years for lining-out stock⁴ to develop into tightly-sheared, well-formed plants of the classes and grades under discussion.

Table 6 shows the time which would have been required for each of the classes and grades to remove one acre-foot of soil at various spacings and packaging intervals. The range for azaleas was about 70 to 240 years, and the range for the deeper-rooted plants was about 50 to 130 years. These figures indicate that the rate of top soil removal directly attributable to marketing B&B stock is lower than commonly believed. Possibly much of the soil deterioration attributed to B&B marketing has been caused by such factors as erosion incidental to clean tillage, soils compacted by excessive overhead irrigation, or inadequate maintenance of the soil-humus relationship.

⁴A young plant, ready for setting in the field.

TABLE 6. THE ESTIMATED TIME* REQUIRED TO REMOVE ONE ACRE-FOOT OF SOIL BY MARKETING, B&B, VARIOUS ORNAMENTAL PLANTS, 1956.

CLASS AND GRADE OF PLANT	YEARS TO REMOVE ONE ACRE-FOOT OF SOIL								
	PLANT SPACING (INCHES)								
	36 x 42			30 x 42			24 x 42		
	YRS. IN FIELD			YRS. IN FIELD			YRS. IN FIELD		
	4	5	6	4	5	6	4	5	6
	No.	No.	No.	No.	No.	No.	No.	No.	No.
Japanese Holly, 18-24" Crowns	70	90	100	60	70	90	50	60	70
Pfitzer Juniper, 18-24" Crowns	70	90	100	60	70	90	50	60	70
Evergreen Azalea, 18" Crowns	100	120	150	80	100	120	70	80	100
Dogwood, 3-4' Height	70	90	110	60	70	90	50	60	70
Japanese Holly, 15-18" Crowns	90	110	130	70	90	110	60	70	90
Pfitzer Juniper, 15-18" Crowns	90	110	130	70	90	110	60	70	90
Evergreen Azalea, 15" Crowns	160	200	240	130	170	200	110	130	160

*Rounded to multiples of 10.

The Labor Practices and Man-Minutes⁵ Involved In Packaging Ornamental Plants B&B

Table 7 shows the average per-plant man-minutes involved in digging and burlapping 1,251 ornamentals in the classes and grades chosen for study. The data were taken without supplementary notes concerning weather or soil conditions. Time employed in carrying the packaged plants to the nearest nursery road also was excluded. No record of individual workers' performances was kept, and no incentive was offered to increase the speed of operation or to alter the normal procedure of work. Usually a field foreman was present, but sometimes a few workers operated without supervision.

The man-minutes presented in Table 7 do not fall into a logical pattern. It took longer to package 15-inch than 18-inch azaleas; 3- to 4-foot dogwoods involved approximately 50 per cent more labor than did 18- to 24-inch junipers; 15- to 18-inch junipers took more labor than the same grade of Japanese holly, although 18- to 24-inch Japanese holly took about 25 per cent more time to package than the same grade of junipers.

In Table 8 variations are even more apparent than in Table 7. Here data are presented for the 28 plant orders studied. Man-minutes

⁵One man's time, expressed in minutes.

TABLE 7. THE MAN-MINUTES INVOLVED IN PACKAGING VARIOUS ORNAMENTAL PLANTS B&B, UNDER CONDITIONS OFFERING NO EXTRA INCENTIVE FOR SPEED, 1956.

CLASS AND GRADE OF PLANTS	PLANTS	AVERAGE MAN-MINUTES PER PLANT
	<i>Number</i>	<i>Minutes</i>
Japanese Holly, 18-24" Crowns	214	10.1
Pfitzer Juniper 18-24" Crowns	168	8.7
Evergreen Azalea, 18" Crowns	50	5.2
Dogwood, 3-4' Height	86	12.3
Japanese Holly, 15-18" Crowns	428	7.1
Pfitzer Juniper, 15-18" Crowns	194	8.5
Evergreen Azalea, 15" Crowns	111	6.8
ALL CLASSES	1251	8.6

TABLE 8. THE MAN-MINUTES INVOLVED IN PACKAGING, B&B, 28 ORDERS FOR VARIOUS ORNAMENTAL PLANTS, UNDER CONDITIONS OFFERING NO EXTRA INCENTIVE FOR SPEED, 1956.

CLASS AND GRADE OF PLANT	PLANTS IN EACH ORDER	MAN-MINUTES PER PLANT	CLASS AND GRADE OF PLANT	PLANTS IN EACH ORDER	MAN-MINUTES PER PLANT
	<i>Number</i>	<i>Minutes</i>		<i>Number</i>	<i>Minutes</i>
Japanese Holly, 18-24" Crown	50	12.2	Evergreen Azalea, 18" Crown		
	20	9.0			
	15	11.0		50	5.2
	15	11.0	Evergreen Azalea, 15" Crown	20	17.7
	50	9.1		50	5.7
	50	9.1		30	1.7
	14	10.0		11	5.5
Japanese Holly, 15-18" Crown	128	6.1	Pfitzer Juniper, 18-24" Crown	20	13.2
	100	11.3		50	10.8
	200	7.5		16	8.1
Dogwood, 3-4' Height	25	19.9		50	6.8
	25	12.0		32	6.1
	20	2.5	Pfitzer Juniper, 15-18" Crown	25	7.2
	16	13.1		100	3.6
				40	21.0
				29	9.0

involved varied from 1.7 per plant in the case of one order for thirty 15-inch azaleas, to 21.0 in the case of forty 15- to 18-inch junipers. Nor were these extremes noticeably isolated. Two orders involved only 2.5 and 3.6 minutes per plant, respectively, and two involved 19.9 and 17.7 minutes each. There was little apparent correlation between digging

and balling time and the classes or grades of plants packaged, except that azaleas involved fewer man-minutes than did the other plant classes.

In 1957 supplementary data were procured which involved only the deeper-rooted broad-leaved evergreens and two species of narrow-leaved evergreens. To study variations in packaging times, nine orders for 15- to 18-inch Japanese hollies were studied. Records were kept of weather and soil conditions. In order to procure more inclusive and precise data on the labor involved, time spent in carrying packaged plants to the nearest nursery roads was recorded, as were the times spent in digging, burlapping, tying crowns, and dropping sacks. Transportation to and from packaging operations was excluded from the records. Each worker's achievement also was tabulated. The nursery manager assured the workers that results would not affect employment or payment and told them that the West Virginia University Agricultural Experiment Station wished to find out how long it would take a "good" man to dig and (or) burlap plants. The manager reported that the men soon developed a spirit of friendly rivalry,⁶ which lasted throughout the series of fourteen orders comprising 1,051 plants.

Table 9 shows the average man-minutes spent per plant in packaging each of the 14 orders. Exclusive of the yews, which had not been included in the first study, these times ranged from 3.0 to 5.0 minutes, in contrast to a previous range of 3.6 to 21.0 minutes for the same plant

"The "champion" burlapper later devised a tool for fastening the burlap wrappings around the soil balls, whereby his labor time was appreciably reduced.

TABLE 9. MAN-MINUTES INVOLVED IN PACKAGING ORNAMENTAL PLANTS B&B UNDER CONDITIONS OFFERING A VOLUNTARY INCENTIVE FOR SPEED, 1957.

CLASS AND GRADE OF PLANT	PLANTS IN EACH ORDER	MAN-MINUTES PER PLANT	CLASS AND GRADE OF PLANT	PLANTS IN EACH ORDER	MAN-MINUTES PER PLANT
	<i>Number</i>	<i>Minutes</i>		<i>Number</i>	<i>Minutes</i>
Japanese Holly, 15-18" Crown	100	3.2	Spreading Yew, 18-24" Crown	51	6.3
	100	3.2	Spreading Yew, 15-18" Crown	50	6.6
	50	3.6	Andorra Juniper, 15-18" Crown	51	3.4
	100	4.2	Pfitzer Juniper, 15-18" Crown	100	3.1
	100	4.2	Glass Holly 18-24"	50	3.1
	99	3.6			
	40	5.2			
	75	3.8			
	75	3.9			
All Orders of 15-18" Holly	749	3.8	All Orders Except 15-18" Holly	302	4.2
ALL PLANT ORDERS			1051		3.9

classes and grades.⁷ The Table shows an over-all average time of 3.8 minutes for 749 of the small hollies, approximately one half of the earlier average of 8.0 minutes for 428 similar plants. The yews took more man-minutes to package than did any other plant class. Apparently the class of plant has more effect on packaging time than does the difference in size between 15- to 18-inch and 18- to 24-inch grades. The man-minutes-per-plant range among the nine orders for the small Japanese hollies, 3.2 to 5.2, was not substantially less than the earlier range of 6.1 to 11.3 among similar plants.

Table 10 indicates that air temperature had little effect on packaging times, the longest time occurring at 50° F. and the shortest at 51°. Because nurseries package most of their plants in the fall and spring, extremes in air temperature seldom occur during balling-and-burlapping.

Table 11 lists soil conditions during the packaging of the small Japanese hollies. The average man-minutes of labor while the soil was muddy or soggy was 4.0, a slight increase over the 3.6 average made when

⁷Azaleas and dogwoods, included in the first study, were not available for the second.

TABLE 10. THE MAN-MINUTES INVOLVED IN PACKAGING, B&B, ONE GRADE* OF JAPANESE HOLLY DURING VARIOUS AIR TEMPERATURES, 1957.

PLANTS IN EACH ORDER	FAHRENHEIT TEMPERATURE	MAN-MINUTES PER PLANT	PLANTS IN EACH ORDER	FAHRENHEIT TEMPERATURE	MAN-MINUTES PER PLANT
<i>Number</i>	<i>Degrees</i>	<i>Minutes</i>	<i>Number</i>	<i>Degrees</i>	<i>Minutes</i>
75	44	3.9	50	51	3.6
75	48	3.8	100	62	4.2
50	50	5.2	100	63	4.2
99	51	3.5	100	64	3.2
100	51	3.1			

*15- to 18-inch crown diameter.

TABLE 11. MAN-MINUTES INVOLVED IN PACKAGING, B&B, ONE GRADE* OF JAPANESE HOLLY FROM FIRM, MUDDY, AND SOGGY SOILS, 1957.

PLANTS IN EACH ORDER	SOIL CONDITION	MAN-MINUTES PER PLANT	PLANTS IN EACH ORDER	SOIL CONDITION	MAN-MINUTES PER PLANT
<i>Number</i>		<i>Minutes</i>	<i>Number</i>		<i>Minutes</i>
100	Firm	3.2	99	Muddy	3.6
100	Firm	3.1	50	Muddy	5.2
50	Firm	3.6	75	Soggy	3.8
100	Firm	4.2	75	Soggy	3.9
100	Firm	4.9			
ALL PLANTS IN DRY SOIL			ALL PLANTS IN WET SOIL		
450	Firm	3.6	299	Muddy or Soggy	4.0

*15- to 18-inch crown diameter.

the soil was firm. However, two orders packaged when the soil was firm averaged more than four minutes each.

Table 12 shows the man-minutes averages made while packaging the smaller hollies during cloudy weather (moist fog or mist). The over-all average during this "cloudy" weather was 4.4 minutes, about 25 per cent longer than the 3.4 average made on fair days (Table 13). When both cloudy weather and muddy soil occurred, the average rose to 5.2 minutes per plant, an increase of about 60 per cent over a 3.3 minute average made during those fair days when the soil was firm.

TABLE 12. MAN-MINUTES INVOLVED AND THE SOIL CONDITION EXISTING WHILE ONE GRADE* OF JAPANESE HOLLY WAS PACKED B&B DURING CLOUDY** WEATHER, 1957.

PLANTS IN EACH ORDER	WEATHER	SOIL CONDITION	MAN-MINUTES PER PLANT
<i>Number</i>			<i>Minutes</i>
100	Cloudy	Firm	4.2
100	Cloudy	Firm	4.2
50	Cloudy	Muddy	5.2

*15- to 18-inch crown diameter.

**Cloudy indicates moist fog or mist, but not steady rain.

TABLE 13. MAN-MINUTES INVOLVED IN PACKAGING, B&B, ONE GRADE* OF JAPANESE HOLLY DURING CLEAR WEATHER FROM FIRM AND WET SOILS.

PLANTS IN EACH ORDER	WEATHER	SOIL CONDITION	MAN- MINUTES PER PLANT	PLANTS IN EACH ORDER	WEATHER	SOIL CONDITION	MAN- MINUTES PER PLANT
<i>Number</i>			<i>Minutes</i>	<i>Number</i>			<i>Minutes</i>
50	Clear	Firm	3.6	99	Clear	Muddy	3.5
50	Clear	Firm	3.1	75	Clear	Soggy	3.8
100	Clear	Firm	3.2				
ALL PLANTS IN FIRM SOIL				ALL PLANTS IN WET SOIL			
200	Clear		3.3	174	Clear		3.7
OVER-ALL AVERAGE ON CLEAR DAYS							3.4

*15- to 18-inch crown diameter.

Table 14 presents the average man-minutes spent by each of 16 workmen in digging and (or) burlapping. The time they spent in carrying out, dropping sacks, and tying crowns is omitted from this table. Workers were included only if they either dug or burlapped a total of at least 30 plants. The nursery manager stated that all of the regular workmen were competing in speed, but that the quality of work did not suffer. Thus the table indicates that there is a wide variation among

workers' ability to dig or burlap effectively and rapidly. No effort was made to determine how much of the variation was caused by experience or lack of experience, by temperament, or by natural abilities. The "champion," however, was a slightly-built man with much experience.

TABLE 14. EACH WORKER'S* AVERAGE TIME PER PLANT FOR DIGGING AND BURLAPPING, 1957.

WORKER'S CODE NUMBER	AVERAGE TIME PER PLANT		WORKER'S CODE NUMBER	AVERAGE TIME PER PLANT	
	<i>Digging Minutes</i>	<i>Burlapping Minutes</i>		<i>Digging Minutes</i>	<i>Burlapping Minutes</i>
1	.7	1.8	9		2.8
2		1.9	10		3.3
3	.9	2.0	11		3.6
4		2.2	12	.8	3.8
5		2.2	13		3.8
6		2.3	14	.9	4.5
7	.7	2.3	15	.9	
8		2.8	16	1.0	

*Only workers who either dug or burlapped at least 30 plants were included in this table.