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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

FRUIT SORTER (agric.; can. & preserv.; whole tr.) 9-68.60
CHERRY SORTER 9-68.60
OLIVE SORTER 9-68.60
PACKER (agric.) 9-68.35
APPLE PACKER 9-68.35
CHERRY PACKER 9-68.35
CITRUS-FRUIT PACKER 9-68.35
PLUM PACKER 9-68.35

B-376 or S-116

U. S. Employment Service in
Cooperation with
California, Florida, and Washington
State Employment Services

U. S. DEPARTMENT OF LABOR
Bureau of Employment Security
Washington 25, D. C.
June 1958

GATB #2079, 2081,
2106, 2144, 2114C
2165C
January 1957

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR FRUIT SORTER 9-68.60 PACKER (agric.) 9-68.35

B-376 or S-116

Summary

The General Aptitude Test Battery, B-1002A, was administered to four samples of workers employed as Fruit Sorter 9-68.60 or Packer (agric.) 9-68.35. The table below shows for each of these samples the type of fruit packed or sorted, the number included in the final experimental samples, and the type of criterion used for validation purposes.

Sample	Fruit Packed	N	Criterion
California	Pears, Plums	74	Supervisory ratings
Florida	Citrus Fruit	57	Supervisory ratings
Washington	Apples	44	Supervisory ratings
California	Cherries	94	Supervisory ratings

The four samples were analyzed separately and in combination. On the basis of the statistical and qualitative analysis of the data, Aptitudes P-Form Perception, F-Finger Dexterity and M-Manual Dexterity were selected for inclusion in the test norms.

GATB Norms for Fruit Sorter 9-68.60 and Packer (agric.) 9-68.35 - B-376 or S-116

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Fruit Sorter 9-68.60 and Packer (agric.) 9-68.35.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for B-376 or S-116

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
P	CB-1-A CB-1-L	70	P	Part 5 Part 7	70
F	CB-1-O CB-1-P	75	F	Part 11 Part 12	70
M	CB-1-M CB-1-N	70	M	Part 9 Part 10	70

Effectiveness of Norms

The data in Table V-E indicate that 40 of the 78 poor workers, or 51 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 51 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 158 of the 196 workers who made qualifying test scores, or 81 percent, were good workers.

TECHNICAL REPORT

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupations of Fruit Sorter 9-68.60 and Packer (agric.) 9-68.35.

II. Samples

This study is based on four samples of employed fruit packers and sorters. The test norms were developed on the basis of the results for all four samples.

A. Sample I (California)

Between August 30, 1955 and November 30, 1955, the GATB, B-1002A, was administered to 109 Plum and Pear Packers from six packing sheds in communities in the vicinity of Auburn, California. This was all of a potential sample of 185 Plum and Pear Packers living within a twenty-five mile radius of Auburn that could be persuaded to take the tests. The transient workers, variously estimated as 100 to 150 in the area during a season, were not included since it was the shed operators' conclusion that they could not be persuaded to take the tests.

Of the 109 packers tested, 35 were excluded from the final sample for the following reasons:

Number Excluded	Reason
12	Over 45 years old
4	Under 16 years old
14	Had college training
1	Language barrier
4	Criterion data not available

The final sample thus consisted of 74 Plum and Pear Packers. All were women.

Sporadic training had been given to some local workers in two of the sheds. Very early fruit was used in actual shed packing conditions and one of the older and more experienced workers demonstrated steps and attempted to correct any awkward motions that the learners exhibited. Some workers were weeded out during this initial period.

B. Sample II (Florida)

This sample consists of two groups of women employed as Citrus-Fruit Packers at the Waverly Growers Coop Packing House, Waverly, Florida and at the Snively Groves, Incorporated, Winter Haven, Florida.

B. The GATB, B-1002A, was administered on June 21, 1955 to a group of 35 women Citrus-Fruit Packers at the Waverly Growers Coop Packing House, Waverly, Florida. Four packers were eliminated from the sample because they did not understand parts of the test. This left a final experimental sample of 31 packers at this plant.

The GATB, B-1002A, was administered between June 24 and July 18, 1955 to a group of 27 women who had been employed as Citrus-Fruit Packers during the past citrus season at the Snively Groves, Incorporated, Winter Haven, Florida. These 27 packers were tested when they reported to the local employment office to make applications for unemployment compensation. No special selection method was used. Those packers who reported in to make applications for unemployment compensation had the study explained to them and were asked to participate. It should be noted that none of the packers refused to participate. Under these circumstances, it is reasonable to believe that the sample should not be considered as a selected or volunteer sample, though the use of claimants might so indicate. One of the 27 packers tested was eliminated from the sample because she did not understand parts of the tests, which left a final experimental sample of 26 packers.

The job duties and the age, education, experience and aptitude profiles of the two samples were found to be sufficiently similar to assume that the job performance levels and therefore, the supervisory ratings were comparable. Thus, the statistical analysis was based on the total sample of 57 women: 31 from Waverly Growers Coop and 26 from Snively Groves, Incorporated.

The minimum hiring age for packers is 18 years. There appears to be no upper limit as long as the worker is physically fit to perform the duties of packer. No minimum amount of education is specified; however, packers are expected to be able to read and write. Experience is not required but is preferred.

C. Sample III (Washington)

On November 19 and December 2, 1954, the GATB, B-1002A, was administered to 44 Apple Packers who had been employed during the packing season at the Wenatchee Wenoka Fruit Company and the Cascadian Fruit Company in Wenatchee, Washington. The tested sample consists of 43 women and one man. All 44 were retained in the final sample.

Only those packers with two or more seasons of packing experience were considered for inclusion in the sample. The Wenatchee Wenoka plant had 60 experienced packers and the Cascadian plant had 30. Of these packers, 32 from Wenatchee Wenoka and 12 from Cascadian volunteered to take part in the testing. The testing was done after the close of the packing season.

The length of the training period is at least one packing season of about three months. This was determined by plotting packing rate against length of experience.

Workers were selected for employment as Apple Packers on the basis of interest in the work, physical ability to work in a standing position for a nine-hour shift and demonstrated aptness at packing in a packing school prior to the packing season.

D. Sample IV (California)

The GATB, B-1002A, was administered during December 1956 and January 1957 to 97 female workers employed in Lodi, California by three companies as Cherry Sorter 9-68.60 and Cherry Packer 9-68.35. Three workers were eliminated from the tested sample: one because of excessive age, one because of a low amount of education and one because of poor attitude. This left a final experimental sample of 94 women, distributed as follows among the three companies in which these workers were employed:

Companies (located in Lodi, Calif.)	N
American National Foods, Inc.	27
Heggblade Marguleas Company	32
Valley Fruit Company	35
Total	94

The potential sample consisted of 202 workers employed by the three companies. Of these workers, 65 were not tested: 17 because of an insufficient amount of experience, 31 because of excessive age or an insufficient amount of education and 17 because they refused to be tested or had a negative attitude toward the project. The balance of 137 workers were scheduled for testing but 40 did not appear and could not be persuaded to be tested at a later date. Thus, 97 workers were tested, and as indicated above, 94 workers were included in the final sample.

There were no special training courses given by the employers. New workers were given on-the-job training by a forelady. The foreladies agreed that in most cases they could determine by the end of the first week if a beginner could become a successful worker.

The selection procedures and hiring requirements at all three companies were much the same. The minimum age requirement was 16 years (legal minimum in California) and there was no maximum age limit. However, the foreladies exhibited considerable hesitation about hiring inexperienced workers over 60 years of age. Workers must be able to stand during the entire shift. There are no educational requirements. Applicants with no experience must agree to stay for the entire season. The foreladies do the hiring and make selections on the basis of a brief interview.

Table II shows the means, standard deviations, ranges and Pearson product-moment correlations with the criterion for age, education and experience for each sample.

TABLE II

Number of Workers in Sample (N), Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience for each Sample

Fruit Sorter 9-68.60
Packer (agric.) 9-68.35

	N	M	σ	Range	r
Age (years)					
Sample I	74	26.4	8.6	16-44	.182#
Sample II	57	41.6	8.9	24-67	-.259
Sample III	44	43.4	11.3	23-67	-.287
Sample IV	94	41.8	8.9	17-58	-.192
Combined	269	37.8	11.6	16-67	---
Education (years)					
Sample I	74	10.8	1.4	7-12	-.200#
Sample II	57	8.4	1.7	5-12	.148
Sample III	44	10.4	2.0	6-14	-.168
Sample IV	94	8.7	1.9	4-13	-.077
Combined	269	9.5	2.0	4-14	---
Experience (seasons)					
Sample I	74	6.5	6.1	1-25	.487**#
Sample II	57	14.3	5.9	3-26	.127
Sample III	44	14.4	10.5	2-38	.091
Sample IV (mos.)	94	11.0	8.7	1/2-45	.206*

\# Corrected for broad categories
* Significant at the .05 level
** Significant at the .01 level

The correlations between experience and the criterion for Sample I and Sample IV are significant, indicating that the more experienced workers in these samples tend to be more productive and/or that the supervisors making the ratings tend to be biased in favor of the more experienced workers. None of the other correlations is significant.

Sample I is considerably younger than the other three samples, Samples I and III have had the most education, and Samples II and III have had the most experience. Sample III shows the greatest variability with respect to age, education and experience. Since available experience data were expressed in months for Sample IV and in seasons for the other samples, and since the length of the fruit packing season varies from year to year, it was not feasible to combine the data to obtain statistics on length of experience for the Combined Sample.

The data in Table II indicate that the four samples are suitable for test development purposes with respect to age, education and experience.

III. Job Descriptions

Job Titles: Fruit Sorter (agric.; can. & preserv.; whole tr.) 9-68.60
Cherry Sorter 9-68.60
Packer (agric.) 9-68.35
Apple Packer 9-68.35
Cherry Packer 9-68.35
Citrus-Fruit Packer 9-68.35
Pear Packer 9-68.35
Plum Packer 9-68.35

APPLE PACKER

Job Summary: Packs pre-graded and sized apples in wooden boxes by hand. Takes empty apple box from overhead conveyor and places box on waist-high mobile packing stand. Inserts corrugated liner in box. Rapidly reaches sideways with one hand to pick apple out of slowly revolving bin and, at the same time, grasps tissue wrap with other hand. Wraps apple and places it in box. Continues this operation, packing box in layers and count according to size of apples being packed. Stamps identifying number on both ends of box. Depresses pedal to tip table so that box slides onto conveyor.

Work Performed: Prepares for packing. Places waist-high mobile packing stand in position. Reaches and grasps empty apple box from overhead conveyor and places box on inclined table of stand. Inserts corrugated liner in box.

Wraps and packs pre-graded and sized apples. Reaches rapidly, and in rhythm, sideways with one hand and takes apple from slowly revolving bin, and at the same time grasps oil tissue wrap from packing stand holder with other hand. Throws apple into wrap, twists wrap to cover apple and packs wrapped apple in box with blossom end toward packer. Continues this operation, packing box in layers and count according to size of apples being packed. Places apples out of grade on return conveyor.

Removes packed box. Stamps or marks identifying number on end of box. Pushes stand one or two feet to waist-high moving belt conveyor. Depresses pedal to tip table so that box (which weighs approximately 50 pounds) slides onto conveyor.

CHERRY PACKER
CHERRY SORTER
Job Summary: Sorts and grades cherries and packs them in a box in a predetermined pattern in order to maintain grade and to produce an attractive box of fruit.

Work Performed: Places empty cardboard-lined box on inclined table bin. Pulls down a small amount of cherries from supply piled on inclined table and scans fruit to determine size of cherries to be packed. Sorts out and tosses doubles and defective cherries with spurs or bird pecks into container placed on shelf above table. Sorts and tosses small, stemless, and choice cherries into other appropriate containers on shelf. Picks up cherries one at a time, with thumb and index finger, and places them in cardboard-lined box with seam side of cherry and stem positioned up. Holds cherry in position with finger of other hand while obtaining and positioning another cherry. Determines number of rows and number of cherries per row in the box on basis of size of cherries being packed. Packs first two layers carefully according to above procedure. Finishes pack by filling the box with loose cherries, following no pattern but maintaining grade. Lifts and carries filled box and places it on scales; notes weight and adds or removes cherries so that packed box meets weight specifications. Places identifying tag on top of packed box. Picks up empty cardboard-lined box and returns to work station. May dump filled box of fruit on to inclined table bin. May use card with standardized holes in order to maintain consistent size of cherries.

CITRUS-FRUIT PACKER
Job Summary: Packs citrus fruit in wooden packing crates, arranging fruit according to size. Places protective strip in front of crate before packing last layer to keep fruit from being pinched when lid is fastened. Packs top layer of fruit, paying special attention to appearance. Stamps size of fruit packed on outside of crate with rubber stamp. Places individual identification ticket through wire on top of crate. Pushes filled crate on box stand to conveyor which takes it to Crate Nailer.

Work Performed: Prepares work station. Picks up identification tickets from office, carries them to work station and places them within reach. Obtains empty crate from rack about three feet above packing bin, turns and places crate on a box stand.

Packs citrus fruit. Stands in front of fruit bin, picks up one or two pieces of fruit in each hand and places them in bottom of crate according to specific "pattern" for the size of fruit being packed. Places fruit in layers until ready for top layer. Picks up a cardboard strip from ledge above packing bin and places it along the inside front edge of crate with about half of it protruding so that it can be folded over to prevent pinching of fruit when lid is fastened. Packs top layer of fruit in crate, paying special attention to appearance. Stamps size of fruit packed on outside of crate with rubber stamp. Pulls lid up and over so that it can be fastened easily. Places identification ticket under wire on top of crate. Rolls filled crate on box stand about three feet to box conveyor and pushes crate onto metal chain tracks which convey it to Crate Nailer.

Occasionally "fancy packs" citrus fruit to fill special orders. Wraps individual fruit in protective tissue or foil paper. Arranges fruit so that company label faces up on each piece. Decorates pack by placing such ornamental fruit as kumquats or loquats in places that make pack attractive. May include jars or glasses of citrus jelly or jam on top layer of pack.

May pack fruit in bags. Places net mesh bag on packing table. (Bags vary in capacity from 6 lbs. to 8 lbs., 20 lbs., and 45 lbs.) Reaches forward into packing bin and places fruit into bag manually until bag is filled. Inserts identification tag into bag. Draws string ends of bag top and ties a double knot. Lifts bag from packing table and places it on floor adjacent to work station for removal to storage or to loading platform.

PEAR PACKER
PLUM PACKER

Job Summary: Selects pears or plums from a bin, tub, or traveling table and packs them in a basket, box, or other container in a prescribed pattern. Stamps container with identifying mark and places container on conveyor.

Work Performed: Selects the proper size box for packing plums or pears according to specific instructions or the size of the fruit to be packed. Selects fruit from a bin, tub, traveling table or endless conveyor belt to correspond to size and layer of the fruit being packed. Rejects cull fruit that has passed the Fruit Sorter. Makes complete selection for size from fruit traveling on a moving endless belt, or makes final selection from fruit first sized by a rope or flexible curtain sizer. May wrap fruit in paper. Places fruit in a basket, box or other container in a prescribed pattern. May insert padding, collar or skims around and between layers of fruit. Packs container so that the number of rows, the number of fruit in a row, the weight of the filled container, and the extent of overfill or "bow" of the last row of fruit will be within prescribed limits. Stamps identifying number on packed container. Lifts, carries, or slides the container onto conveyor. Rotates from station to station on the packing line, progressing from packing the smallest to packing the largest fruit so that each packer has equal opportunity to pack the most desirable sizes.

IV. Experimental Battery

All of the tests of the GATB, B-1002A, were administered to each sample.

V. Criterion

A. Sample I (California)

Supervisory ratings in three broad categories were used as the criterion.

Each foreman was instructed to classify each of his workers into one of the following three classifications: "Superior," "Good Workers, or Will Become Good Workers," and "Not so Good, or Will Take a Long Time." It was explained to each foreman that these descriptions of the categories had been selected to aid him in comparing each worker with the total population of fruit packers with whose work he was familiar, and to permit him to make a correction for the learning period. Charts showing the three classifications were spread out in front of the foremen at the time they rated their workers. Nine foremen provided the ratings. The number of workers rated by each foreman ranged from 2 to 16.

The distribution of ratings in the three broad categories and the quantitative values corresponding to the broad categories computed for use in the statistical analysis are shown below.

Criterion Group	N	Quantitative Value
Superior	22	62
Good	35	49
Not so Good	17	37

B. Sample II (Florida)

The criterion consists of rank order ratings made by the packing house foreman (first line supervisor) of each packing house. Additional rank order ratings for the workers were made by each of the packing house superintendents (second line supervisors). The rank order ratings were converted to linear scores based on the normal curve. The linear scores of the two subsamples were combined into one distribution for the total sample of 57 workers.

Packing house superintendent ratings were not used in the final analysis of this study because it was established that the packing house foreman has the opportunity for closer observation of packers, and, therefore, should have the most valid knowledge of the quantity and quality of the work performed by packers.

Production records based on the average hourly rate earned by packers over a period of one week were also obtained for each worker. It was not possible to obtain production records over a longer period of time since it was a problem to obtain a period of at least one week when all packers were working and all varieties of fruit were available and being continuously supplied to the packers; also it could not be established that all of the packers had an equal chance to pack their maximum of fruit. For these reasons production records were not used as the final criterion.

Table III shows the intercorrelations (product-moment correlations) of the foreman ratings, superintendent ratings, and production records.

TABLE III

Product-Moment Intercorrelations of Foreman Ratings, Superintendent Ratings and Production Records for Sample II - Florida

N = 57

	Production Records Average Hourly Earnings	Foreman Ratings
Foreman Ratings	.727	---
Superintendent Ratings	.499	.660

Reasonably high agreement was obtained between foreman ratings and superintendent ratings. There was considerably more agreement between foreman ratings and production records than between superintendent ratings and production records. This is additional evidence that foreman ratings should be selected as the criterion for this study.

In addition to preparing rank order ratings for the workers, the packing house foremen also rated the packers as "good," "average," and "poor." Although approximately one-third of the packers in each sample were placed in each of these broad categories, the raters did not force this distribution. These broad category ratings were not used to compute product-moment correlations with the aptitudes, but were used for dividing the sample into high and low criterion groups when the selective efficiency of various sets of test norms was evaluated by means of the tetrachoric correlation technique.

C. Sample III (Washington)

The criterion consists of the average number of boxes packed per hour for the three-month packing season. The criterion scores ranged from 12.0 to 20.8. The mean score was 16.9. The standard deviation was 2.0.

D. Sample IV (California)

The criterion consists of rank order ratings (converted to linear socres) by the first line supervisors, the foreladies. The procedure for ranking was an adaptation of the Rank Comparison Rating Method. The first line supervisor at each of the three plants ranked her workers on three different dates. The dates ratings were made by the supervisor at each company are shown below:

Company	Dates Ratings were Made (all dates were in 1956)		
Valley Fruit Company	7/24;	8/15;	10/17
Heggblade Margueleas Company	8/14;	10/23;	11/29
American National Food Company	7/24;	8/14;	10/17

The first ratings made by each supervisor were selected as the final criterion since they were the most recent ratings made after the cherry packing season closed in June 1956. The linear scores for the three subsamples were combined into one distribution for the total sample of 94 workers. The product-moment correlation between the selected criterion of first ratings and the total of second and third ratings made by the supervisors was .93, indicating that the criterion has good reliability.

VI. Statistical and Qualitative Analysis

The job duties of the kinds of fruit packers and sorters covered by this study are basically the same. When more than one sample performing the same job or closely related jobs are available and the data are comparable, it is desirable to combine them in the statistical analysis because of the greater stability of results obtained on large samples. Therefore, the analysis of data for fruit packers and sorters was based on combined samples where such combinations could be justified statistically.

Table IV-A shows the means and standard deviations for the aptitudes of the GATB for each sample separately and for the combined sample. The means and standard deviations are comparable to general working population norms with a mean of 100 and a standard deviation of 20 for each aptitude.

Table IV-B shows the correlations between the criterion and the aptitudes of the GATB for each sample.

TABLE IV-A

Means (M) and Standard Deviations (σ) for the Aptitudes of the GATB for Each Sample Separately and for the Combined Sample

Fruit Sorter 9-68.60
Packer (agric.) 9-68.35

Aptitudes	Sample I California (N = 74)		Sample II Florida (N = 57)		Sample III Washington (N = 44)		Sample IV California (N = 94)		Combined Sample (N = 269)	
	M	σ	M	σ	M	σ	M	σ	M	σ
G-Intelligence	97.6	14.4	80.6	14.8	94.9	12.7	84.7	16.0	89.1	16.3
V-Verbal Aptitude	98.3	15.4	84.2	14.4	99.7	14.0	86.5	14.4	91.4	16.0
N-Numerical Aptitude	93.8	15.7	73.7	16.4	86.2	13.9	80.6	20.4	83.7	18.8
S-Spatial Aptitude	100.4	16.3	83.7	14.9	96.6	15.3	88.1	15.8	91.9	17.0
P-Form Perception	103.2	18.4	75.6	17.9	88.1	16.0	84.7	20.1	88.4	21.1
Q-Clerical Perception	106.6	15.5	81.4	12.8	93.4	14.0	88.2	15.5	92.7	17.5
K-Motor Coordination	111.6	15.7	81.2	20.0	93.9	15.2	96.5	17.8	97.0	20.4
F-Finger Dexterity	105.5	18.9	89.0	15.7	99.9	20.9	92.8	18.2	96.6	19.5
M-Manual Dexterity	110.4	27.5	83.7	24.1	102.5	20.2	89.9	22.4	96.3	26.1

TABLE IV-B

Pearson Product-Moment Correlations between the Criterion and the Aptitudes of the GATB for Each Sample

Fruit Sorter 9-68.60
Packer (agric.) 9-68.35

Aptitudes	Sample I# California (N = 74)	Sample II Florida (N = 57)	Sample III Washington (N = 44)	Sample IV California (N = 94)
G-Intelligence	-.093	.342**	-.025	.080
V-Verbal Aptitude	-.039	.399**	-.052	.086
N-Numerical Aptitude	.000	.401**	-.087	.155
S-Spatial Aptitude	-.160	.211	.083	.072
P-Form Perception	.295*	.384**	.065	.239*
Q-Clerical Perception	.212	.360**	-.042	.176
K-Motor Coordination	.205	.435**	.126	.183
F-Finger Dexterity	.165	.361**	.334*	.230*
M-Manual Dexterity	.450**	.523**	.134	.211*

\# Correlations Corrected for broad categories
* Significant at the .05 level
** Significant at the .01 level

The statistical results were interpreted in the light of the qualitative analysis of the work performed by fruit packers and sorters. The following aptitudes appear important from a qualitative analysis of the jobs:

Form Perception (P) - required to recognize differences in size and shapes of fruit, to select the correct size of fruit for a predetermined size of box and packing pattern, and to visualize the various patterns in which the fruit is packed. Required to pack fruit in prescribed pattern and to visually inspect fruit for imperfections.

Motor Coordination (K) - required to coordinate hands and eyes in picking up fruit and fruit wrap simultaneously and placing fruit in wrap so that the trade name is properly displayed, and in picking up fruit in both hands simultaneously to place it in the pack. according to a predetermined pattern. Required to place liners in boxes, grasp apples and paper, wrap the apples, and place apples in the boxes. Required to pick up proper size cherries and place them in box and to pick up and discard imperfect cherries.

Finger Dexterity (F) and Manual Dexterity (M) - required to pick up fruit and place it in proper position in container.

A comparison of the mean aptitude scores in Table IV-A shows that, in general, Sample I has the highest mean scores and Sample II has the lowest mean scores. For each aptitude, the difference between the highest and lowest mean scores is quite large. The profiles of mean aptitude scores for the four samples are quite similar, however. For the total sample, the highest mean scores in decreasing order of magnitude, were obtained for Aptitudes K, F and M, respectively.

The data in Table IV-B show that, except for Aptitude S, each aptitude has a significant correlation with the criterion in at least one of the four samples. Aptitudes P, F and M have significant correlations in three samples. None of the aptitudes has a significant correlation in all four samples.

On the basis of the qualitative and quantitative evidence cited above, Aptitudes P, K, F and M warranted further consideration for inclusion in the test norms. Aptitudes F and M were selected for consideration because they appeared important on the basis of the qualitative analysis of the jobs, had relatively high mean scores, and had a significant correlation with the criterion in three of the four samples. Aptitude K was selected because this aptitude appeared important on the basis of the qualitative analysis and had a relatively high mean score. Aptitude P was selected because this aptitude appeared important on the basis of the qualitative analysis and had a significant correlation with the criterion in three samples. None of the other aptitudes were considered further for inclusion in the norms because none appeared important from the qualitative analysis, none had a relatively high mean score, and none had a significant correlation with the criterion in more than one of the four samples.

Various combinations of Aptitudes P, K, F and M with appropriate cutting scores were selected as trial norms. The relationship between each set of trial norms and the dichotomized criterion was determined for each sample separately and for the total sample. A comparison of the results showed that norms consisting of P-70, F-70 and M-70 had better selective efficiency than any other set of norms tried.

In test development studies, an attempt is made to develop a set of norms such that the cutting score for each aptitude will be set at a five-point score level close to one standard deviation below the aptitude mean of the experimental sample. Adjustments of cutting scores from one standard deviation below the mean are made to effect better selective efficiency of the norms. In the case of this study the aptitude cutting scores are each within ten points of one standard deviation below the aptitude mean of the combined sample.

VII. Concurrent Validity of Norms

In order to compute tetrachoric correlation coefficients between the norms and the criterion for the four separate samples and for the combined sample, the criterion for each sample was dichotomized.

The criterion for Sample I was dichotomized by placing those workers with ratings of "Not so Good" in the low criterion group. Workers with ratings of "Good" and "Superior" were placed in the high criterion group.

The broad category ratings were used as the basis for dichotomizing the criterion for Sample II. This was done by placing those workers with ratings of "Poor" in the low criterion group. Workers with ratings of "Average" and "Good" were placed in the high criterion group.

The criterion for Sample III was dichotomized by placing those workers whose average number of boxes packed per hour was less than 16.7 in the low criterion group. All other workers were placed in the high criterion group. The critical score of 16.7 was chosen as the point of dichotomy because the employers indicated that they were reluctant to retain packers who packed at less than this rate after one season of experience.

The criterion for Sample IV was dichotomized so that approximately one fifth of the sample was placed in the low criterion group. This proportion, rather than one-third, was placed in the low criterion group for the following reasons: (1) The study was conducted after the packing season was over and all the unsatisfactory workers had been separated at this point, leaving a high proportion of satisfactory workers available for the study; (2) It was noted that most of the 57 workers who either refused or did not appear for testing were ranked at the lower end of the scale.

Tables V-A, V-B, V-C and V-D show the relationship between test norms consisting of Aptitudes P, F and M with minimum scores of 70, 70 and 70, respectively, and the dichotomized criterion for Sample I, Sample II, Sample III and Sample IV. Table V-E, a composite of these four tables, shows the relationship between the test norms and the criterion for the combined sample. Workers in each low criterion group have been designated as "poor workers" and workers in each high criterion group have been designated as "good workers."

TABLE V-A

Relationship between Test Norms Consisting of Aptitudes P, F and M with Critical Scores of 70, 70 and 70, Respectively, and the Dichotomized Criterion for Sample I (California)

Packer (agric.) 9-68.35
N = 74

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	3	54	57
Poor Workers	6	11	17
Total	9	65	74

$r_{tet} = .72$ $\quad X^2 = 8.422$

$\sigma_{r_{tet}} = .26$ $\quad P/2 < .005$

The data in the above table indicate a significant relationship between the norms and the criterion for Sample I.

TABLE V-B

Relationship between Test Norms Consisting of Aptitudes P, F and M with Critical Scores of 70, 70 and 70, Respectively and the Dichotomized Criterion for Sample II Florida

Packer (agric.) 9-68.35
N = 57

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	11	26	37
Poor Workers	16	24	20
Total	27	30	57

$r_{tet} = .72$ $\quad X^2 = 11.220$

$\sigma_{r_{tet}} = .21$ $\quad P/2 < .0005$

The data in the above table indicate a significant relationship between the norms and the criterion for Sample II.

TABLE V-C

Relationship between Test Norms Consisting of Aptitudes P, F and M with Critical Scores of 70, 70 and 70, Respectively, and the Dichotomized Criterion for Sample III (Washington)

Packer (agric.) 9-68.35
N = 44

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	1	23	24
Poor Workers	6	14	20
Total	7	37	44

r_{tet} = .73 $\quad X^2$ = 3.682

$\sigma_{r_{tet}}$ = .29 $\quad P/2 < .05$

The data in the above table indicate a significant relationship between the test norms and the criterion for Sample III.

TABLE V-D

Relationship between Test Norms Consisting of Aptitudes P, F and M with Critical Scores of 70, 70 and 70, Respectively, and the Dichotomized Criterion for Sample IV (California)

Fruit Sorter 9-68.60
Packer (agric.) 9-68.35
N = 94

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	18	55	73
Poor Workers	12	9	21
Total	30	64	94

r_{tet} = .51 $\quad X^2$ = 6.496

$\sigma_{r_{tet}}$ = .19 $\quad P/2 < .01$

The data in the above table indicate a significant relationship between the test norms and the criterion for Sample IV.

TABLE V-E

Relationship between Test Norms Consisting of Aptitudes P, F and M with Critical Scores of 70, 70 and 70, Respectively, and the Dichotomized Criterion for the Combined Sample

Fruit Sorter 9-68.60
Packer (agric.) 9-68.35
N = 269

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	33	158	191
Poor Workers	40	38	78
Total	73	196	269

r_{tet} = .57 $\quad X^2 = 30.690$

$\sigma_{r_{tet}}$ = .11 $\quad P/2 < .0005$

The data in the above table indicate a significant relationship between the test norms and the criterion for the combined sample.

VIII. Conclusions

On the basis of mean scores, correlation coefficients, the job analysis data and their combined selective efficiency, Aptitudes P, F and M with minimum scores of 70, 70 and 70, respectively, are recommended as B-1002 norms for the occupations of Fruit Sorter 9-68.60 and Packer (agric.) 9-68.60. The equivalent B-1001 norms are P-70, F-75 and M-70.

IX. Determination of Occupational Aptitude Pattern

When the specific test norms for an occupationa include three aptitudes, only those occupational aptitude patterns which include these three aptitudes with cutting scores that are within 10 points of the cutting scores established for the specific norms are considered for that occupation. One of the existing 23 Occupational Aptitude Patterns meets these criteria for this study. This occupational aptitude pattern and its B-1002 norms is OAP-16 (P-75, F-80 and M-80). The selective efficiency of this OAP for the combined sample was determined by means of the tetrachoric correlation technique. A significant relationship (r_{tet} = .43, $\sigma_{r_{tet}}$ = .10) was obtained between OAP-16 and the dichotomized criterion and this OAP screened out a proportion of the sample (.46) that was within the required range of .10 to .60. Therefore, it is recommended that OAP-16 be used in counseling for the occupations of Fruit Sorter 9-68.60 and Packer (agric.) 9-68.35.

PART II

I. Summary

After the analysis for the four samples covering the occupations of Fruit Sorter 9-68.60 and Packer (agric.) 9-68.35 was completed and the B-376 norms were established, test development data became available for a sample of Olive Sorters 9-68.60. It was found that the B-376 norms showed good selective efficiency for the sample of Olive Sorters as well as for the total combined sample. The data in Table VIII-B show the relationship between the test norms and combined sample of Fruit Sorters, Olive Sorters, and Packers (agric.). The data in this table indicate that 53 of the 97 poor workers, or 55 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 55 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 188 of the 232 workers who made qualifying test scores, or 81 percent, were good workers.

II. Sample

The GATB, B-1002A, was administered April 2 and 3, 1956, to 72 of the 73 women employed as Olive Sorters 9-68.60 at the Lindsay Ripe Olive Company, Lindsay, California. One worker was not willing to participate in the study. Of the 72 workers tested, 14 were omitted from the final sample; 13 because they were over 60 years of age, and one because she had difficulty understanding the instructions and attempted few items in each test part. Therefore, the final sample consisted of 58 women.

Training consists of on-the-job instruction given by the supervisor. Workers can achieve satisfactory production in approximately three weeks. There are no experience or education requirements, although the company prefers to hire workers who have at least an eighth grade education.

Data for the study on Olive Sorter 9-68.60 were considered in conjunction with data for the four samples of Fruit Sorters 9-68.60 and Packers (agric.) 9-68.35. The sample of Olive Sorters has been designated as Sample V.

Table VI-A shows the means, standard deviations, ranges, and Pearson product-moment correlations with the criterion for age, education, and experience for the study on Olive Sorter 9-68.60. Table VI-B shows the means, standard deviations, and ranges for age and education for the Combined Sample of Olive Sorters and the samples of Fruit Sorters and Packers (agric.).

TABLE VI-A

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience

Olive Sorter 9-68.60
N = 58

	M	σ	Range	r
Age (years)	47.8	8.1	30-60	-.367**
Education (years)	9.3	2.0	6-13	.437**
Experience (months)	67.8	55.9	3-236	.012

** Significant at the .01 level
* Significant at the .05 level

TABLE VI-B

Means (M), Standard Deviations (σ) and Ranges, for Age and Education

Combined Sample
Olive Sorter 9-68.60
Fruit Sorter 9-68.60 and Packer (agric.) 9-68.35
N = 327

	M	σ	Range
Age (years)	39.6	11.7	16-67
Education (years)	9.4	2.0	4-14

The data in Table VI-A indicate that there is no significant correlation between experience and the criterion. The negative correlation between age and the criterion and the positive correlation between education and the criterion may indicate a bias on the part of the supervisors in favor of the younger workers who probably have more education, or it may indicate that the younger workers with more education tend to be more proficient on the job. The data in Table VI-A indicate that the sample is suitable for test development purposes with respect to age, education and experience. Since it was not feasible to combine the experience data to obtain statistics on length of experience for the four samples for Fruit Sorters and Packers (agric.), data for experience for the combined sample is not shown in Table VI-B.

III. Job Description

Job Title: Olive Sorter 9-68.60

Job Summary: Grades olives as they pass along conveyor belt. Observes appearance, texture, and color (degree of ripeness). Using thumb and forefingers of each hand "picks out" culls (fruit with blemishes or defects which make them unfit for canning), overripe, and "off color" fruit, and drops them in proper conveyor channel leading to discard bins. Removes stems, leaves, and other extraneous material.

Work Performed: Performs in one or more of the following operations in the sorting of olives.

"Green" Sort (Receiving and Grading): Grades and sorts olives for condition only. Using thumb and forefingers of each hand "picks out" off-grade olives, leaves, and foreign material from stream of fruit passing along conveyor belt, and with a twisting motion drops fruit into palm of hands, and "tosses off" leaves or foreign material. When palms are filled, drops off-grade olives in proper conveyor channel leading to discard bins.

While required only to sort out off-grade fruit and extraneous material, must do so rapidly in order to keep pace with the continuous flow of olives from the receiving conveyor belt onto the sorting conveyor belt. Careful handling of olives is required so as not to bruise fruit. Sorters wear gloves, and sit or stand, while working. Fruit is graded for size by mechanical sizer before going to storage holding tanks.

"Wet" Sort: Grades and sorts olives for processing. The olive "Grade color" (maturity) determined by the foreman is fixed for the sorters for each lot of olives graded. Using thumb and forefingers of each hand "picks out" shriveled, overripe "oils," and "off-color" fruit, from stream of fruit passing along conveyor belt, and with twisting motion drops fruit into palm of hands. When palms are filled, drops off-grade fruit in proper conveyor channel leading to discard bins. Destems olives that were missed by mechanical destemer.

Sorters wear rubber gloves, and sit or stand, while working. Olives from storage or fermentation tanks are destemmed by mechanical destemmer before going to "wet" sort. The "flow" of olives before the olive sorters is regulated to the quantity of "sort out" required for each lot of fruit. Olives are also conveyed between various processing points in running water "channels" to avoid fruit bruising.

Canning Sort: Grades and sorts processed olives for canning. Using thumb and forefingers of each hand picks up off-size, machinery bruised (table culls), and overripe olives from stream of processed fruit passing along conveyor belt, and with a twisting motion drops fruit ino palm of hands. When palms are filled, drops olives into proper conveyor channel leading to discard bins.

Sorters wear rubber gloves, and sit or stand, while working. Careful handling of olives is required so as not to bruise fruit. This is final sort before olives go to can filling bowl.

IV. Experimental Battery

All the tests of the GATB, B-1002A, were administered to the sample group.

V. Criterion

The criterion for this study consisted of rank order ratings converted to linear scores made by the first line and second line supervisors. Ratings and reratings were made by each supervisor. The correlations between the two sets of ratings made by the first line and second line supervisors were .97 and .96, respectively. The ratings and reratings made by each supervisor were averaged and a correlation was obtained between the averaged ratings (.81). An average of the averaged linear scores of the ratings and reratings made by the two supervisors was used as the final criterion for this study.

VI. Statistical and Qualitative Analysis

Data for the sample of Olive Sorters and the combined samples of Fruit Sorter and Packer (agric.) were analyzed separately and in combination on the basis of both statistical and qualitative considerations.

A. Statistical Analysis: Table VII-A shows the means, standard deviations, and Pearson product-moment correlations with the criterion for the aptitudes of the GATB, for Olive Sorter 9-68.60. The means and standard deviations are comparable to general working population norms with a mean of 100 and a standard deviation of 20 for each aptitude.

Table VII-B shows the means and standard deviations for the aptitudes of the GATB, for the Combined Sample.

TABLE VII-A

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

Olive Sorter 9-68.60
N = 58

Aptitudes	M	σ	r
G-Intelligence	86.8	16.5	.439**
V-Verbal Aptitude	90.9	14.6	.559**
N-Numerical Aptitude	78.1	18.1	.294*
S-Spatial Aptitude	90.3	18.9	.293*
P-Form Perception	76.9	18.6	.278*
Q-Clerical Perception	85.8	12.5	.479**
K-Motor Coordination	97.3	16.9	.106
F-Finger Dexterity	91.1	19.8	.183
M-Manual Dexterity	92.6	19.2	.382**

** Significant at the .01 level

TABLE VII-B

Means (M) and Standard Deviations (σ) for the Aptitudes of the GATB

Fruit Sorter 9-68.60
Olive Sorter 9-68.60
Packer (agric.) 9-68.35
N = 327

Aptitudes	M	σ
G-Intelligence	88.7	16.4
V-Verbal Aptitude	91.3	15.8
N-Numerical Aptitude	82.7	18.8
S-Spatial Aptitude	91.6	17.3
P-Form Perception	86.4	21.1
Q-Clerical Perception	91.5	16.9
K-Motor Coordination	97.0	19.8
F-Finger Dexterity	95.7	19.6
M-Manual Dexterity	95.6	25.1

Table VII-A, which presents data for the sample of Olive Sorters, shows that the highest mean scores in descending order of magnitude were obtained for Aptitudes K, M, F, V, and S, respectively. All the aptitudes have standard deviations of less than 20, with Aptitude Q exhibiting the smallest standard deviation. When N = 58, correlations of .337 and .259 are significant at the .01 level and the .05 level, respectively. Aptitudes G, V, Q, and M show significant correlations at the .01 level, and Aptitudes N, S, and P show significant correlations at the .05 level with the criterion.

Table VII-B, which presents means and standard deviations of the aptitudes for the Combined Sample, shows that the highest mean scores in decreasing order of magnitude were obtained for Aptitudes K, F, and M, and that the lowest standard deviations were obtained for Aptitudes G and V.

B. Qualitative Analysis:

The job analysis for Olive Sorter indicated that the following aptitudes measured by the GATB appeared to be important for this occupation:

Form Perception (P) - required to visually inspect olives for imperfections and to recognize differences in size of olives.

Motor Coordination (K) - required in coordinating hand and finger movements in picking up as many of the off-grade olives as quickly as possible and tossing off foreign materials as the olives pass on a moving belt.

Finger Dexterity (F) and Manual Dexterity (M) - required in picking up olives rapidly and in tossing off foreign material with fingers while hands are partially filled; in reaching out to pick up olives; in the twisting and turning motions of hands to drop olives into palms and in tossing accumulated handfuls into proper conveyor channel.

C. Selection of Test Norms:

Consideration was given to Aptitudes P, K, F, and M for inclusion in the test norms. Aptitudes P and M show significant correlations with the criterion. Aptitudes K, F, and M show the highest mean scores for this sample of Olive Sorters and all these aptitudes appear to be important in terms of the job analysis data. Although Aptidudes V and S had high mean scores and significant correlations with the criterion, and Aptitudes G, N, and Q also had significant correlations with the criterion, none of these aptitudes were considered further for inclusion in the norms because they had been eliminated for final consideration for the other four samples in B-376 on the basis of the reasons cited in the statistical and qualitative analysis of those data. Several sets of norms consisting of various combinations of Aptitudes P, K, F, and M with appropriate cutting scores were tried. The relationship between each set of trial norms and the dichotomized criterion was determined by means of the tetrachoric correlation technique. The selective efficiency of norms consisting of P-70, F-70, and M-70 was better than the selective efficiency of any other set of norms tried for all the samples combined and these norms also showed good selective efficiency for each sample taken separately. The cutting scores for Aptitudes P, F, and M are each within 10 points of one standard deviation below the sample mean.

VII. Concurrent Validity of Norms.

For the purpose of computing the tetrachoric correlation coefficient between the test norms and the criterion and applying the Chi Square test for the Olive Sorter sample, the criterion was dichotomized by placing one-third of the sample in the low criterion group. Those workers who received a criterion score of 40 or more were placed in the high criterion group and those with a score of 39 or less were placed in the low criterion group. This placed 19, or 33 percent of the 58 workers, in the low criterion group.

Table VIII-A shows the relationship between test norms consisting of P-70, F-70, and M-70 and the dichotomized criterion for Olive Sorter 9-68.60. Table VIII-B, a composite of the tables which show the relationship between the above norms and the dichotomized criterion for each of the samples of Fruit Sorter, Packer (agric.), and Olive Sorter, shows the relationship between the test norms and the criteria for the Combined Sample of 327 workers. Workers in each low criterion group have been designated as "poor workers" and workers in each high criterion group have been designated as "good workers."

TABLE VIII-A

Relationship between Test Norms Consisting of Aptitudes P-70, F-70, and M-70 and the Criterion for Olive Sorter 9-68.60

N = 58

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	9	30	39
Poor Workers	13	6	19
Total	22	36	58

$r_{tet} = .66$ $\quad X^2 = 9.315$

$\sigma_{r_{tet}} = .22$ $\quad P/2 < .005$

The data in the above table indicate a significant relationship between the test norms and the criterion for this sample.

TABLE VIII-B

Relationship between Test Norms Consisting of Aptitudes P-70, F-70, and M-70 and the Criterion for the Combined Sample

Fruit Sorter 9-68.60
Olive Sorter 9-68.60
Packer (agric.) 9-68.35
N = 327

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	42	188	230
Poor Workers	53	44	97
Total	95	232	327

$r_{tet} = .59$ $\quad X^2 = 42.058$

$\sigma_{r_{tet}} = .10$ $\quad P/2 < .0005$

The data in the above table indicate a significant relationship between the test norms and the criterion for the Combined Sample.

VIII. Conclusions

On the basis of the qualitative and quantitative analysis of the data for Olive Sorter and the other four samples in B-376, Aptitudes P, F, and M each with a minimum score of 70 are recommended as B-1002 norms for the occupations of Fruit Sorter 9-68.60, Olive Sorter 9-68.60, and Packer (agric.) 9-68.35. The equivalent B-1001 norms consist of P-70, F-75, and M-70.

IX. Determination of Occupational Aptitude Pattern

When the specific test norms for an occupation include three aptitudes, only those occupational aptitude patterns which include these three aptitudes with cutting scores that are within 10 points of the cutting scores established for the specific norms are considered for that occupation. One of the existing 23 Occupational Aptitude Patterns meets these criteria for this study. This Occupational Aptitude Pattern is OAP-16, and its B-1002 norms are P-75, F-80, and M-80. The selective efficiency of this OAP for the combined sample of 327 was determined by means of the tetrachoric correlation technique. A tetrachoric correlation of .50 with a standard error of .09 was obtained, which indicates a significant relationship between OAP-16 and the criteria for the combined sample. The proportion of the sample screened out by OAP-16 was .49, which is within the required range of .10 and .60. Therefore, it is recommended that OAP-16 be used in counseling for the occupations of Fruit Sorter 9-68.60, Olive Sorter 9-68.60, and Packer (agric.) 9-68.35.