# An Econometric Approach to Forecast Farm Labor for Perennial Labor Intensive Agricultural Crops

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***Selected Poster prepared for presentation at the Agricultural and Applied Economic Association's 2014 AAEA Annual Meeting, Minneapolis, MN, July 27-29, 2014.***

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## INTRODUCTION

From 1999 to 2011 the number of seasonal agricultural workers in Washington state increased from 31,774 to 40,282. Fewer available workers at current wage levels are expected in the future due to demographic trends and non-farm economic opportunities in Latin America. US immigration policy is also uncertain.

- Apples, cherries, pears, and grapes accounted for 61.2% of the demand for hired farm labor in Washington in 1999, which increased to 73.3% in 2011.
- Labor accounted for 42% of the variable production expenses for U.S. fruit and vegetable farms. (USDA-ERS)
- Monthly distribution of seasonal agricultural workers for each labor intensive crop is different due to different harvest season. (See Fig.2)

**Fig.1 Seasonal Agricultural Workers for Main Labor Intensive Crops in WA, 1999-2011**

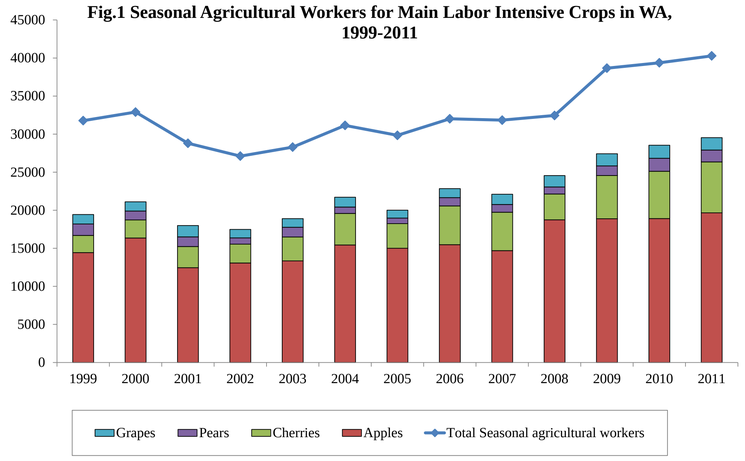
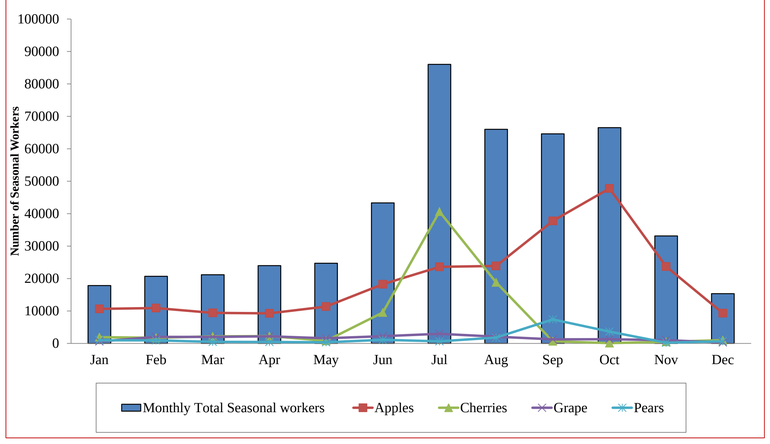



**Fig.2 Employment of Seasonal Workers by Crop in Washington State, 2011**




## OBJECTIVE

The objectives of this study:

- To predict the change in bearing acreages for the labor intensive crops using econometric estimation methods.
- To forecast the future labor demand based on predicted production for each labor intensive crops in Washington State.
- To provide information for both growers and policy makers.

## DATA

- Annual time series of bearing acreages, yield per acre, for apples, cherries, grapes, and pears in Washington State from 1970 to 2012.
- Labor input coefficients for each crop in Washington State
- Employment of Seasonal Workers by crop in Washington State
- Average Weekly Hours Worked by Farmworkers

Data Source:

- USDA, National Agricultural Statistics Service, Washington Statistics
- Crop Enterprise Budgets, Washington State University
- Employment Security Department/LMEA, Agricultural Labor Employment and Wages Survey
- U.S. Department of Agriculture, National Agricultural Statistics Service, AGRI-FACTS, various issues

## MODEL

Total labor hours demanded for each crop *i* is

$$L^i{}_t = BA^i{}_t \times a^i{}_t$$

where $BA^i{}_t$ is bearing acreage for crop *i* (*i= apples, cherries, grape, and pears*) at year t, $a^i{}_t$ is labor input coefficient with unit of hours per acre for crop *i* at year t. The number of seasonal labor demanded can be calculated by using total labor hours predicted divided by the average weekly hours worked. Four steps to follow:

**Step 1**: Recover historical labor input coefficient, $a^i{}_t$, for each crop *i*, $a^i{}_t = LS^i{}_t/(\rho^i \times BA^i{}_t)$

$LS^i{}_t = SL^i{}_t \times 40hrs/week \times 48\text{weeks}$

Where $\rho^i$is the coefficient of using bearing acreage and enterprise budgets and employment of seasonal workers for each crop,$LS^i{}_t$is total labor hours calculated using number of seasonal workers for each crop $SL^i{}_t$.

**Step 2**: Estimate the bearing acreage $BA^i{}_t$ for each crop from t=2013 to t=2034 using econometric method.

**Step 3**: Estimated total labor hours demanded by growers for each crop by multiplying the predicted $BA^i{}_t$ and predicted $a^i{}_t$.

**Step 4**: Derive predicted number of seasonal workers from step 3 and calculate the monthly seasonal workers based on information provided by Fig.2.

## RESULTS

**Fig.3 Predicted Bearing Acreage for Apples in WA, 1970-2034**

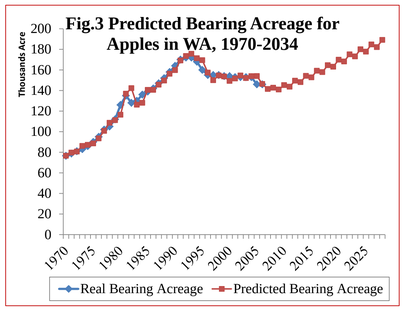



**Fig.4 Predicted Bearing Acreages for Cherries in WA, 1970-2034**

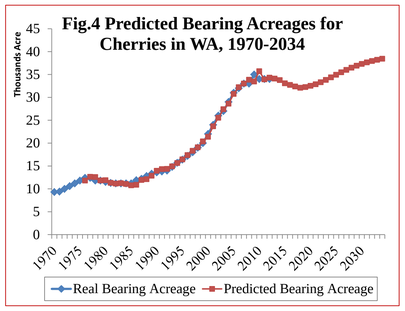



**Fig.5 Predicted Bearing Acreges for Grape in WA, 1970-2034**

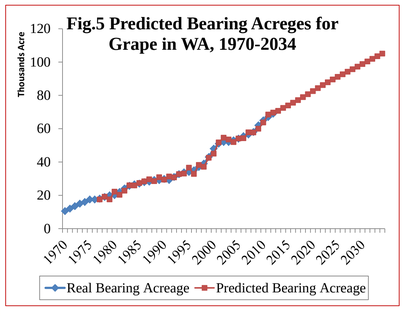



**Fig.6 Predicted Bearing Acreges for Pears in WA, 1970-2034**

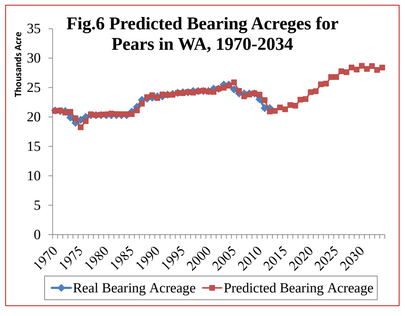
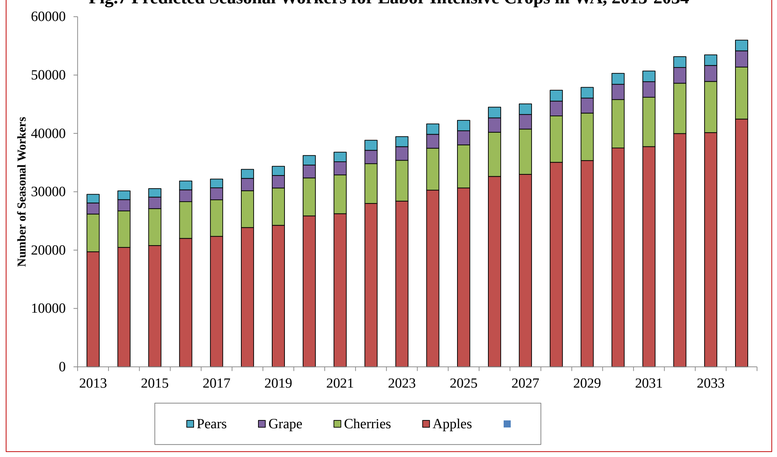



**Fig.7 Predicted Seasonal Workers for Labor Intensive Crops in WA, 2013-2034**




## CONCLUSION AND DISCUSSION

- Results constitute the baseline case where production of labor intensive crops in Washington State is forecasted assuming no limits to labor availability (Fig.7).
- In 30 years from now, the apple industry would require double the amount of current farm labor, the cherry industry 38%, grape industry 46%, and pear industry 23%.
- Fig3-Fig6 show the predicted bearing acreages for labor intensive crops with an upward trend for each crop, especially for grape industry.
- The labor intensive crops face big challenges, especially for harvesting seasons, from July to October, in case of farm labor shortage.
- Apple industry absorbs around half of total labor demand in WA state and would face the largest challenge if available workers become more scarce.