

OBA 466 / 566 Model Formation

Team 5

Contributing members: Tira Durrell, Chuck Gunderson, Riley Folet, Keller Leet

Decision Variables

$X_{i,t}$ = acres of crop i planted in period t

Objective Function

$$(Y_1P_1X_1 + Y_2P_2X_2 + Y_3P_3X_3 + Y_4P_4X_4 + Y_5P_5X_5 + Y_6P_6X_6 + Y_7P_7X_7 + Y_8P_8X_8 + Y_9P_9X_9 + Y_{10}P_{10}X_{10} + Y_{11}P_{11}X_{11} + Y_{12}P_{12}X_{12} + Y_{13}P_{13}X_{13} + Y_{14}P_{14}X_{14}) - ((W_1X_1 + W_2X_2 + W_3X_3 + W_4X_4 + W_5X_5 + W_6X_6 + W_7X_7 + W_8X_8 + W_9X_9 + W_{10}X_{10} + W_{11}X_{11} + W_{12}X_{12} + W_{13}X_{13} + W_{14}X_{14}) * Z)$$

Our objective function is the profit of the farm, revenue from crops minus the cost of irrigation. We maximized the amount of profit while considering acres of crop planted ($X_{i,t}$), yield per acre in CWT (Y_i), and profit per acre (P_i). The second half of the objective function, the cost, considers acres of crop planted ($X_{i,t}$), irrigation demand for crop i (W_i), and cost of irrigation (Z).

Main Constraints

$$x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_8 + x_9 + x_{10} + x_{11} + x_{12} + x_{13} + x_{14} \leq A_t \text{ (Monthly Acreage)}$$

$$A_1, A_2, \dots, A_{12} = 430 \text{ (Monthly Acreage Constraint)}$$

$$x_{1,3} + \dots + x_{1,8} = x_1 \text{ (Barley)}$$

$$x_{2,4} + \dots + x_{2,11} = x_2 \text{ (Grain Corn)}$$

$$x_{3,4} + \dots + x_{3,9} = x_3 \text{ (Alfalfa)}$$

$$x_{4,4} + \dots + x_{4,10} = x_4 \text{ (Hay)}$$

$$x_{5,4} + \dots + x_{5,10} = x_5 \text{ (Potatoes)}$$

$$x_{6,4} + \dots + x_{6,7} = x_6 \text{ (Spring Wheat)}$$

$$x_{7,1} + \dots + x_{7,7} + x_{7,10} + x_{7,11} + x_{7,12} = x_7 \text{ (Wheat, Winter)}$$

$$x_{8,5} + \dots + x_{8,9} = x_8 \text{ (Beans, Snap)}$$

$$x_{9,4} + \dots + x_{9,9} = x_9 \text{ (Corn, Sweet)}$$

$$x_{10,2} + \dots + x_{10,8} = x_{10} \text{ (Onions, Dry)}$$

$$x_{11,5} + \dots + x_{11,9} = x_{11} \text{ (Squash)}$$

$$x_{12,4} + \dots + x_{12,6} = x_{12} \text{ (Peas, Green 1)}$$

$$x_{13,8} + \dots + x_{13,10} = x_{13} \text{ (Peas, Green 2)}$$

$$x_{14,3} + \dots + x_{14,8} = x_{14} \text{ (Hops)}$$

$$x_{i,t} \geq 0 \text{ for all } i, t \text{ (Non negativity)}$$

Our first two constraints regard monthly acreage, first stating that for each month the sum of all crops planted must be less than or equal to farm acreage (A_t). Then that all months of the year

the farm size remains the same . We restrict the acres of crop planted to the seasonal timing of the crop. We also have a nonnegativity constraint as we cannot plant a negative amount of any crop to maximize profit.