

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.