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ORIGINAL ARTICLE

Development of Linear Encoding Problem to Minimize Fish Feeds

R. Palani, B. Kannan, M. Ramar and S. Balasubramanian
College of Fisheries Engineering, Tamil Nadu Dr. J. Jayalalithaa Fisheries University
Nagapattinam - 611 002, Tamil Nadu, India
Email: rpalanispm@gmail.com

ABSTRACT
This study, tradition of linear encoding problem on price minimization on fish feeds was aimed to reduce the cost of production of fish feeds. The data used was collected using both main and subordinate data. Linear programming problem was used to evaluate the data and the optimum solution was obtained at 2nd iterations with fingerlings feeds to be 1.2 of tons and grower's feeds to be 0.8 tons and the least cost of producing the tones of fingerlings and growers is Rs. 93,358. We formerly mention that any fish farmer who surely wants to board on efficient and effective fish production should use linear programming problem to determine the minimums cost of production. In other to make best use of their incomes.
Keywords: *Fish feeds, Tilapia fish, fingerlings, growers, LPP.*

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INTRODUCTION

The Inland fish farmers are striving hard to reduce the cost of fish feed since fish feed accounts for over 50% of the total cost of fish production. Supplementary feeds providing additional quantities of nutrients are needed when the productivity of a water body cannot provide for the fish growth desired. Low-cost, high quality feeds are needed in ponds when farmers wish to produce more fish than can be supported from fertilized systems and in instances where cages are stocked with fish which do not have access to the entire water body for feeding. Many small-scale farmers have been stimulated to build and apply cages to increase their household income and nutrition. Commercial feeds are widely used around the world, mostly for cage farms which require a fairly complete diet. The compulsion to meet infinite needs with restricted resources is one of the biggest tasks encountered in the market today [6-9]. Linear programming (LP) is a powerful analytical tool that can be used to determine an optimal solution that satisfies the constraints and requirements of the current situation [2, 5].
This method consists of three quantifiable components [6]:
(1) Objective function (maximization of profit or minimization of costs);
(2) Constraints (limitation of production sources);
(3) Decision variables.
In formulating the linear programming problem, the assumption is that a series of linear (or approximately linear) relationships involving the decision variables exist over the range of another possibility being considered in the problem [7, 6]. LP output not only provides an optimal solution, it also provides sensitivity analysis. Sensitivity analysis evaluates how changes in the objective function coefficients affect the optimal solution of a linear programming model. It could examine how well the changes of objective function coefficients and the right hand side value could affect the optimal solution [1].

1. The complication of today's business operations, the high cost of technology, materials and labour as well as modest pressure and the shortened time frame in which many important decision must be made contribute to the difficultly of making effective decisions. All this question are very difficult to answer because it depends on so many different economic, social and political factors and view point, very few business decisions are made which are not primarily based on quantitative measures of

some nature. It must be stressed though that, timely and proficient decision analysis should be an aid to the decision maker's decision, not a temporary for it.
2. Factually, fish farming in Nigeria dates back to 1944 when it started as a means of rushing fish production. The leading fashionable fish farm was built in 1954 in panyam; Plateau State.
3. Nowadays, over 10,000,000 private and government owned fish farms exist in different part of the country
4. Even though the fact that large scale profitable fish farming appears to be the only hope for meeting demand for fish in Nigeria, there are some notable constraint to a viable aquaculture development, and such problems include lack of adequate formulated diet for reasonable price and high diet value.
5. The source of aquaculture growth lies in fingerlings manufacture and formulation of economy and efficient fish feds to produce fish at minimum cost hence the problem of fish feeds development needs special attention for the nutrition of fish farm.

ALGORITHMS FOR SIMPLEX METHOD

Step I: If the problem is of minimization, convert it to maximization problem by multiplying the objective function z by (-1).

Step II: See that all b_i 's, multiply it by (-1) to make b_i positive.

Step III: Convert all the inequalities to equalities by addition of a slack variables artificial variables or by subtraction of surplus variables as the case may be.

Step IV: Find the starting basic feasible solution.

Step V: Construct the starting simplex table

Step VI: Testing for the optimality of basic feasible solution by computing $z_j - c_j$ if $z_j - c_j$ >0, the solution is optimal, otherwise, we proceed to the next step.

Step VII: To improve on the basic feasible solution we find the IN-COMING VECTOR entering the basic matrix and the OUT-GOING VECTOR to be removed from the basic matrix. The reviable that corresponds to the most negative $z_j - c_j$ is the IN-COMING VECTOR. While the variable that corresponds to the minimum ratio b_i / a_j for a particular j and a_{ij} >0 is the OUT-GOING VECTOR.

Step VIII: The KEY ELEMENT or the pivot element is determined by considering the intersection between the arrows that correspond to both the in-coming and the out-going vectors. The key element is used to generate the next table in the next table, the pivot element will be replaced by zero. To calculate the new values for all other elements in the remaining rows of the pivot column we use the relation:
New row = former element in the old row – (intersectional element of the old row) x (corresponding element of replacing row).
In this way we get the improved

Step IX: Test this new basic feasible solution not optimal, repeat the process till optimal solution is obtained.

METHODOLOGY OF L.P.P FORMULATION

The ingredients were collected from local feed ingredients supplier, Namakkal for preparation of floating feed for juvenile and grow out period of GIFT Tilapia. Research tells that, for producing one tons of feed for Juvenile GIFT Tilapia the crude protein (CP) level should be in the range of 30-35 % and for grow out culture the CP in the range of 25-28% respectively [8]. Locally available feed ingredients for better formulation to produce one tones of floating feed for Juvenile GIFT Tilapia is given in the Table: II. For grower GIFT Tilapia soya flour inclusion is needed more compare to other five ingredients (Tanle: III). For both juvenile and grower period of Tilapia the ingredients like soya and corn are required as maximum for formulation followed by fish meal, wheat. (Table: IV)
The general linear programming problem can be presented in a tabular form as show below.

INGREDIENT	x_1	x_2---	x_n	SOLUTION (DI)
1	a_{11}	a_{12}	a_{1n}	b_1
2 . .	a_{21} . .	a_{22} . .	a_{2n} . .	b_2 . .
m	a_{m1}	a_{m2}---	a_{mn}	b_n
Cost (N)	c_1	c_2---	c_n	

The above table can be interpreted in the below form.

Optimize $z = c_1x_1 + c_2x_2 + \cdots + c_nx_n$ ------------------- (1)

Subject to the constraints

$a_{11}x_1 + a_{12}x_2 + \cdots \quad + a_{1n}x_n \leq or = or \geq b_1$

$a_{21}x_1 + a_{22}x_2 + \cdots \quad + a_{2n}x_n \leq or = or \geq b_2$

$a_{31}x_1 + a_{32}x_2 + \cdots \quad + a_{3n}x_n \leq or = or \geq b_3$ ---------- (2)

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$a_{m1}x_1 + a_{m2}x_2 + \cdots \quad + a_{mn}x_n \leq or = or \geq b_m$

And the non-negative restrictions

$x_1, x_2, x_3, \ldots\ldots x_n \geq 0.$ ------------------------ (3)

PRESENTATION OF DATA

In other to complete the minimization in fish feeds, the following data were collected.

TABLE-I: Locally available ingredient required for best formulation to produce one tones of floating feed for fingerlings period of GIFT Tilapia

Sl. No	Ingredients	Inclusion levels (%)	Required quantity (in Kg.)	Cost (Rs.)	Proximate composition (%)
1	Soya flour	32.5	325	15600	Digestible matter :89.83 Crude protein:28 Lipid: 4.43 Fiber :3.14
2	Fish meal	13	130	12350	
3	Cassava flour	15	150	5700	
4	Corn	29.25	292.5	8190	
5	Wheat	10	100	3000	
6	Vit. And mineral mixture	0.25	2.5	1000	

TABLE-II: Locally available ingredient required for best formulation to produce one tones of floating feed for growing of juvenile GIFT Tilapia

Sl. No	Ingredients	Inclusion levels (%)	Required quantity (in Kg.)	Cost (Rs.)	Proximate composition (%)
1.	Soya flour	30	300	14,400	Digestible matter :89.97 Crude protein:33 Lipid: 04 Fibre :03
2.	Fish meal	15.5	155	14,725	
3.	Yeast (brewers)	14.25	142.50	6412.5	
4.	Corn	30	300	8400	
5.	Wheat	10	100	3000	
6.	Vit. And mineral mixture	0.25	2.5	1000	

TABLE-III: Available ingredient to produce a tonne each of both fingerling and grower of GIFT Tilapia feeds

Sl. No	Ingredients	Max.available(kg)	Cost (Rs.)
1	Soya flour	1000	48000
2	Fish meal	500	47500
3	Cassava flour	180	6840
3	Yeast (brewers)	180	8100
4	Corn	1000	28000
5	Wheat	200	6000
6	Vit. And mineral mixture	5	2000

TABLE-IV: The quantity of finished ingredients required to make feeds of tilapia fingerlings (a) and growers (b) fish

Ingredient	Fingerling (a)	Growers (b)	The Availability Ingredient
Soya flour	325kg	300kg	1000kg
Fish meal	130kg	155kg	500kg
Cassava flour	150kg	-	180kg
Yeast(brewers)	-	142.5kg	180kg
Corn	292.5kg	300kg	1000kg
Wheat	100kg	100kg	200kg
Vit. and mineral mixture	2.5	2.5	5kg
Cost	Rs. 45,840	Rs. 47, 937.5	

The data collected for this research is based mainly on both primary and secondary source. The types of ingredients which made up the ration is attracted ingredients which is determined through the market survey. Also, the officers in charge of the fishing was also interrogated on the ways and the proportion with which the materials is being mixed.

DATA ANALYSIS

From Table-IV

Let fingerlings feeds = X_1

Let grower's feeds = X_2

Objective function

$$Minimize\ Z = 45840\ X_1 + 47937.5\ X_2$$

THE CONSTRAINTS

For Soya flour : $325X_1 + 300X_2 \leq 1000$

For Fish meal : $130X_1 + 155X_2 \leq 500$

For Cassava flour : $150X_1 + 0X_2 \leq 180$

For Yeast (brewers) : $0X_1 + 142.5X_2 \leq 180$

For Corn : $292.5X_1 + 300X_2 \leq 1000$

For Wheat : $100X_1 + 100X_2 = 200$

For Vit. And mineral : $2.5X_1 + 2.5X_2 = 5$

$$X_2, X_2 \geq 0$$

The linear programming problem

$$Minimize\ Z = 45840\ X_1 + 47937.5\ X_2$$

Subject to the constraints

$$325X_1 + 300X_2 \leq 1000$$
$$130X_1 + 155X_2 \leq 500$$
$$150X_1 + 0X_2 \leq 180$$
$$0X_1 + 142.5X_2 \leq 180$$
$$292.5X_1 + 300X_2 \leq 1000$$
$$100X_1 + 100X_2 = 200$$
$$2.5X_1 + 2.5X_2 = 5$$
$$X_2, X_2 \geq 0$$

Using six pap software for the linear programming problem. Hence the cost has being minimized when the objective function is Rs. 93,358

With $X_1 = 1.2,\ X_2 = 0.8.$

CONCLUSION

From the study the cost of production was reduced to Rs. 93,358in the 2nd iteration and it is noted that 1.2of a ton of fingerlings feeds was produced whereas the production level for growers feeds intensification to 0.8of a ton. By reducing. The cost of feeding to the smallest amount, there will be a total increase in the profit for the fish farmers.

REFERENCES

1. Anderson, D. R., D. J. Sweeney and T. A. Williams. (2000). An introduction to management science. Quantitative approaches to decision making. 9th Ed. South- Western college publishing.US.p.88-145.
2. Andino, J. R. (1999). Effect of colored plastic mulch in watermelon insects, growth, yield and economics. Electronic thesis and dissertation library. Louisiana State University.
3. Ansari, M. A., F. A. Shah, M. Whittaker, M. Prasad and T. M. Butt. (2007). Control of western flower thrips (Frankliniella occidentalis) pupae with Metarhizium anisopliae in peat and peat alternative growing media. Biological Control. V40 (3):293–297.
4. Bernd Gartner, Jiri Matousek. (2006). Understanding and Using Linear Programming.
5. Betters, D. R. 1988. Planning optimal economic strategies for agroforestry systems. Agroforest System. V7:17–31
6. Chinneck, J. W. 2004. Practical optimization: A general introduction. http://www.sce. carleton.ca/faculty /chinneck/po/Chapter13.pdf.
7. Gerdness Inc. (1992). Quantitative Approaches to Management 8th edition
8. National Research Council. 1993. Nutritional requirements of fish, National Press, Washigton, D.C.
9. Ozsan, O., F. Simsir and C. Pamukcu. 2010. Application of linear programming in production planning at marble processing plants. Journal of Mining Science. V46(1):57-65.

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