Indian J.Sci.Res. 4(2) : 27-30, 2013

ISSN : 0976-2876 (Print)
ISSN : 2250-0138 (Online)

EFFICIENT UTILIZATION OF RESOURCES: A CATALYST TO PROFIT OPTIMIZATION IN POULTRY FEEDS MILLS

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ABSTRACT

The recent record increase in poultry farm has eventually results to increase in number of the local poultry feeds mills in Nigeria due to rampage of unemployment among the youths. Poultry production company is no longer have access to low cost grain or energy sources and other nutrient sources which affects the diet and the delivery cost of the feeds. In order to maintain the quality of the outputs, attaining optimum profit in a feeds mill, the feeds producers must focus on using standard feeds composition formula and the companies must be able to identify the feeds that optimized her profit among the several alternatives. A random selection of six local poultry feeds mills was taken in Oyo town and Oke-Ogun area of Oyo State, Nigeria. Their product which includes Grower's mash, Layer's mash, Chick's mash, Broiler's starter, and Broiler's finisher were examined in this study with respect to the ingredients of the feeds. Using linear programming approach, the result obtained from the result of the analysis of the AMPL software reveals that Grower's mash, Layer's mash, Chick's mash, Broiler's starter, and Broiler's finisher should be producing in ratio 22:27:17:19:15 respectively.

KEYWORDS : Optimum Profit, Composition Formula, Feeds Mill

In poultry production, the birds ration has a different proportion of nutrient combinations which exactly depends on the types and age of the poultry birds. The ration directly or indirectly determines the growth rate, susceptibility to diseases and productivity of the poultry birds, which eventually contributes to profit or loss in poultry production. To avoid the effect of wrong nutrient combination on poultry birds (particularly the fowls), the animal scientists have come up with different form of poultry feeds (mash). Among them are chick's mash, grower's mash, layer's mash, broiler's starter and broiler's finishers. Chick's mash is prepared for chick's consumption.

Lauren Ware explains that the consumption of chick's mash starts when the chick is a day old up till about 6 weeks. The grower's mash is prepared to speed up the growth rate of the bird after it has been fed with chicks mash. Also, the layer's mash is prepared for the adult layers that are reared purposely for egg production while broilers starter and finishers are majorly prepared for broilers alone. In order to have appropriate nutrient combination for the poultry birds, feeds mills have taken such responsibility upon themselves with aim of producing quality product and profit making.

Generally, paramount among many goals of any business organization is profit making without compromising quality of products. To sustain the quality of the products and to optimize the profit, the company must choose among the available product alternatives, the most efficient use of production resources. To solve this problem, the Linear Programming is the most recommended. Liner programming is a technique for determining an optimum schedule of interdependent activities in view of the available resources. (Verma , 2005). Linear programming indicates the right combination of the various decision variables which can be best employed to achieve the objectives taking full account of the practical limitations within which the problem must be solved.

LINEAR PROGRAMMING MODEL

Hamdy (2007) state the linear programing model as follow:

Maximize or Minimize $Z = \sum_{j=1}^{n} Cj\,Xj$

Subject to $\sum_{j=1}^{n} a_{ij}x_i\ (\leq = \geq) b$

$X \geq 0$ Where i = 1,2,3, -----------, m and $Xj \geq 0$, j = 1,2,3 -------, n

The problem is usually expressed in matrix form, and then becomes $\max\{C^T x / Ax \leq b, x \geq 0\}$

$$C^T \quad (c_1, c_2, c_3 \ldots c_n) \quad X \quad \begin{matrix} x_1 \\ x_2 \\ x_3 \\ . \\ . \\ x_n \end{matrix} \quad b \quad \begin{matrix} b_1 \\ b_2 \\ b_3 \\ . \\ . \\ b_m \end{matrix} \quad A \quad \begin{matrix} a_{11}a_{12} \ldots\ldots\ldots a_{1n} \\ a_{21}a_{22} \ldots\ldots\ldots a_{2n} \\ . \\ . \\ . \\ a_{m1}a_{m2} \ldots\ldots\ldots a_{mn} \end{matrix}$$

Where:

Z = value of the objective function i.e net return or profit

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Xj = A vector of decision variables

Cj = Vector of profits associated with one unit of each activity

bi = Column vectors of the constrain values which are limits of input or output of various activities.

A = an m×n matrix of coefficient that classically relate resources used by an activities to resources constrains, but in general give amount of inputs and outputs for a unit of each activity.

MODEL DEVELOPMENT

Maximize $Z = \sum_{j=1}^{n} C_j X_i$

Subject to $\sum_{j=1}^{n} a_{ij} x_i \leq b_i$

PKC: $a_{1j}x_j \leq b_1$

Maize: $a_{2j}x_j \leq b_2$

BDG: $a_{3j}x_j \leq b_3$

Wheat over: $a_{4j}x_j \leq b_4$

GNC: $a_{5j}x_j \leq b_5$

Soya meal: $a_{6j}x_j \leq b_6$

Octal Shell $a_{7j}x_j \leq b_7$

Bone Meal $a_{8j}x_j \leq b_8$

Fish Meal $a_{9j}x_j \leq b_9$

Premix $a_{10j}x_j \leq b_{10}$

Methionine $a_{11j}x_j \leq b_{11}$

Glycine $a_{512}x_j \leq b_{12}$

Salt $a_{13j}x_j \leq b_{13}$

$X_j \geq 0$

LINEAR PROGRAMMING ANALYSIS

Matrix Format

The matrix format below applies to production problems in the poultry feeds mills in Oyo and Oke-ogun area of Oyo state in Nigeria. Five different products were considered i.e. Growers mash, Layers mash, Chicks mash, Broilers starter and Broilers Finisher. The mathematical expression of problem arrangement is as deduced from the matrices of the study area as shown below. Where: x_1 = A unit of Grower's mash, x_2 =A unit of Layer's mash, = x_3, = a unit of Chick's mash, x_4= a unit of Broiler's Starter x_5= A unit of Broiler's Finisher

Linear programming problem is given thus:

Max $Z = 7.08X_1 + 11.35X_2 + 11.32X_3 + 1.4X_4 + 2.84X_5$

Subject to

$0.12X_1 + 0.2X_2 + 0.24X_4 + 0.25X_5 \leq 280$

$0.42X_1 + 0.5X_2 + 0.44X_3 + 0.32X_4 + 0.21X_5 \leq 862$

$0.12X_1 + 0.04X_5 \leq 56$

$0.2X_1 + 0.02X_2 + 0.08X_3 + 0.028X_4 + 0.12X_5 \leq 160$

$0.04X_1 + 0.06X_2 + 0.14X_3 + 0.08X_4 + 0.32X_5 \leq 224$

$0.04X_1 + 0.09X_2 + 0.14X_3 + 0.056X_4 + 0.06X_5 \leq 235$

$0.02X_1 + 0.06X_2 + 0.1X_3 + 0.08X_4 + 0.02X_5 \leq 100$

$0.04X_1 + 0.04X_2 + 0.08X_3 + 0.6X_4 + 0.02X_5 \leq 84$

$0.00248X_1 + 0.011X_2 + 0.02X_3 + 0.00024X_4 \leq 12$

$0.0001X_1 + 0.005X_2 + 0.001X_3 + 0.0041X_4 \leq 4$

$0.00025\ X_1 + 0.0005X_2 + 0.00025X_3 + \leq 0.4$

$0.0003X_1 + 0.005X_2 + 0.002X_3 + 0.005X_5 \leq 4.3$

$0.0004X_1 + 0.001X_2 + 0.005X_3 + 0.00024X_4 + 0.01X_5 \leq 6$

$X_1 \ldots X_5 \geq 0$

This linear programming problem can be expressed in standard form by adding slacks

Max $Z = 7.08X_1 + 11.35X_2 + 11.32X_3 + 1.4X_4 + 2.84X_5$

Subject to

$0.12X_1 + 0.2X_2 + 0.24X_4 + 0.25X_5 + S_6 = 280$

$0.42X_1 + 0.5X_2 + 0.44X_3 + 0.32X_4 + 0.21X_5 + S_7 = 862$

$0.12X_1 + 0.04X_5 + S_8 = 56$

$0.2X_1 + 0.02X_2 + 0.08X_3 + 0.028X_4 + 0.12X_5 + S_9 = 160$

$0.04X_1 + 0.06X_2 + 0.14X_3 + 0.08X_4 + 0.32X_5 + S_{10} = 224$

$0.04X_1 + 0.09X_2 + 0.14X_3 + 0.056X_4 + 0.06X_5 + S_{11} = 235$

$0.02X_1 + 0.06X_2 + 0.1X_3 + 0.08X_4 + 0.02X_5 + S_{12} = 100$

$0.04X_1 + 0.04X_2 + 0.08X_3 + 0.6X_4 + 0.02X_5 + S_{13} = 84$

$0.00248X_1 + 0.011X_2 + 0.02X_3 + 0.00024X_4 + S_{14} = 12$

$0.0001X_1 + 0.005X_2 + 0.001X_3 + 0.0041X_4 + S_{15} = 4$

$0.00025X_1 + 0.0005X_2 + 0.00025X_3 + S_{16} = 0.4$

$0.0003X_1 + 0.005X_2 + 0.002X_3 + 0.005X_5 + S_{17} = 4.3$

$0.0004X_1 + 0.001X_2 + 0.005X_3 + 0.00024X_4 + 0.01X_5 + S_{18} = 6$

COMPUTATION OF DAILY EXPECTED PROFIT FOR THE COMPANY

Based on one hundred and sixty eight days sampled daily output, the expected in table 1 & 2 Daily

Table 1 : Data Presentation

Materials in Kg	Growers mash	Layers mash	Chicks mash	Broilers starter	Broilers finisher	Daily available materials (kg)
PKC	0.12	0.2	0	0.24	0.24	280
Maize	0.42	0.5	0.44	0.32	0.21	862
BDG	0.12	0	0	0	0.04	56
Wheat over	0.2	0.02	0.08	0.028	0.12	160
GNC	0.04	0.06	0.14	0.08	0.32	224
Soya meal	0.04	0.09	0.14	0.056	0.06	235
Octal shell	0.02	0.06	0.1	0.08	0.02	100
Bone meal	0.04	0.04	0.08	0.06	0.02	84
Fish meal	0.00248	0.011	0.02	0.00024	0	12
Premix	0.0001	0.005	0.001	0.0041	0	4
Metholine	0.00025	0.0005	0.00025	0	0	0.4
Glycine	0.0003	0.005	0.002	0	0.005	4.3
Salt	0.0004	0.001	0.005	0.00024	0.01	6

SOURCE: Lord of Mercy Feeds and Feeds Mill, Oyo

Table 2 : The Company's Cost And Selling Prices Per Kilogramme As At October 2012

	Growers mash	Layers mash	Chicks mash	Broiler starter	Broiler finisher
Cost price/Kg	₦52.92	₦58.65	₦78.68	₦58.60	₦57.16
Selling price/Kg	₦60	₦70	₦90	₦60	₦60
Profit	₦7.08	₦11.35	₦11.32	₦1.4	₦2.84

SOURCE: Computed from field survey of the studied area

output for the mills is calculated.(appendix 1)

Expected profit $= \sum \beta i\, E(Xi)$

$E(Z) = \beta 1E(X_1) + \beta 2E(X_2) + \beta 3E(X_3) + \beta 4E(X_4) + \beta 5E(X_5)$

$E(Z) = 7.08(357.68) + 11.35(337.36) + 11.32(193.76) + 1.4(283.34) + 2.84(294.88)$

$E(Z) = 9788.9$

The variance is given as $\sum \beta^2 i\, V(Xi) + 2\sum \beta i \beta j Cov(XiXj)$

$V(Z) = \beta^2_1 V(X_1) + \beta^2_2\, V(X) + \beta^2_3\, V(X_3) + \beta^2_4\, V(X_4) + \beta^2_5\, V(X_5)$.

Since $Cov(XiXj) = 0\ V\ i, j$ are independent

$V(Z) = 7.08^2(16445.297) + 11.35^2(22418.78) + 11.32^2(5152.781) + 1.4^2(6763.22) + 2.84^2(8802.74)$

$V(Z) = 4456931.837$

Confidence interval for the expected profit is given

95% C.I [E (Z)]

$C.I = E(Z) \pm Z_{0.95\%} S.D/\sqrt{n}$

$C.I = 9788.9 \pm 1.96\sqrt{(4456931.8370/168)}$

$C.I = 9788.9 \pm 1.96(162.878)$

$C.I = [9788.9-319.24, 9788.9+319.24]$

$C.I = [9469.66, 10108.14]$

From the result in the table, 3 it can be observed that linear programming output is higher than daily expected output; this indicates that the mills have not reach her optimal level of production. But if the feeds mills can

Table 3 : Summary of Company's Daily Output

Mash	Expected Output	Linear Programming Output
Grower’s mash	357.68	380.97
Layer’s mash	337.36	462.23
Chick’s mash	193.76	294.56
Broiler’s Starter	283.34	330.77
Broiler’s Finisher	294.88	257.08

efficiently utilize their materials, the optimal value could be achieved which will eventually contribute to the mills daily overall profit in table.

CONCLUSION

In this study, a model has been constructed for feeds production under profit maximization procedure for poultry feeds mills to allocate available resources between diverse of poultry feeds using the linear programming methods. Using AMPL software, the results reveals that 380.97kg of grower's mash, 462.23kg of layer's mash, 294.56kg of chick's mash, 330.77kg of broiler starter, and 257.08kg of broiler finisher should be producing on daily bases in order to let the company have daily maximum profit of₦12471.27.

95% confidence interval was also computed for the expected daily profit and it can be observed that the maximum profit obtained from the objective function (₦12471.27) is higher than the upper limit value (10108.14) in the confidence interval. The result indicates that the company has not attained the daily optimum profit but when compared the profit margin of the company with the objective value, we observed that the company's overall expected profit achieved 72.6% of the linear programming profit.

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