ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 3, Issue 4, October 2013

Heuristic Approach to Goal Programming Problem for Animal Ration Formulation

Radha Gupta, Ravinder Singh Kuntal, Kokila Ramesh
Department of Basic Sciences, School of Engineering and Technology,
Jain University, Bangalore

Abstract*— The focus of this paper is to study the effectiveness of Genetic Algorithm for optimization of ration of Indian dairy cows with 10 Litre of daily milk yield, considering non-linear weighted sum Goal programming formulation. The model construction of non-linear goal programming approach involves square root of sum of the squares of the deviations, where weight is assigned to each goal according to its priority. The algorithm is tested at three levels of weights for dairy cows and results obtained are more acceptable than that of Result obtained by earlier techniques used by different researchers. All the goals are achieved with minimum deviations. In addition, the proposed algorithm provides many possible sets of solutions to reduce the cost of the diet without losing the quality of ration. The results obtained using GA is found to be better as compared to the Random Search Technique for global optimization.

Index Terms—**Ration cost formulation, Non-Linear Goal Programming, Genetic Algorithm**

I. INTRODUCTION

Ration can be termed as the form of food given to the animals on daily basis and the ration formulation is a process by which different ingredients are combined in a proportion to provide animals with a consumable quantity of feedstuffs that will supply all required nutrients in adequate amounts. It is very much essential to formulate ration, as it is one of the major requirements in animal yield industries. Linear programming is one of the most commonly used methods followed in many commercial and non-commercial feed formulation programs. But Rehaman and Romero (1984) point out that LP have many limitations when formulating rations in practice. The assumptions in the LP method restrict objective function to be single and constraints to be fixed – right-hand side (RHS). This means the reduction of A goal-programming model consists of constraints and set of goals, which are prioritized some times. The objective of goal programming is to find the solution, which satisfies the constraints, and come close to the stated goals of respective problem. Theoretically, goals could be satisfied completely, partly, or in some extreme cases, some of them might also not be met. This violence is measured using positive and negative deviation variables that are defined for each goal separately, commonly known as over- or under-achievement of the goal. Since the objective function of the WGP formulation minimizes the sum of total deviation from set goals, the obtained result might yield compromise solution between contradictory goals. We extend our approach to non-linear WGP by taking the square root of sum of the squares of the deviations, to formulate the ration cost of Indian Dairy cows in three different levels,

a) Level 1 – Those cows who does not produce milk and they need ration for maintaining body function.
b) Level 2- Those cows that need ration not only for maintenance but also for 10 Litre milk with 4% fat production.
c) Level 3- Those female cows that need ration for third trimester of pregnancy [13].

Looking into need of ration for all above levels, three hypothetical models were selected in which Animal 1 needed ration for maintaining body function (maintenance ration), Animal 2 which needed ration not only for maintenance but for 10 Litre milk with 4% fat production and Animal 3 that needed ration for third trimester of pregnancy.

In the present study, we have used Genetic Algorithm developed in Mat lab 7.0 to optimize linear and Non-linear weighted sum Goal programming model of ration formulation quoted in Shrabani [13] and compared the results of proposed technique with that of excel solver.

II. DATA AND METHODS

The secondary data for the present study is extracted from the work of Shrabani [13], which is a Linear Goal Programming model of ration formulation of Dairy cows. The work in the present paper focuses on the effectiveness of Genetic Algorithm for optimization of ration of Indian dairy cows with 10 Litre of daily milk yield, considering non-linear weighted sum Goal programming formulation. The general mathematical model of Goal Programming problem is as follows:

Minimize $Z = \sum_{i \in m} p_i \left(d_i^+ + d_i^- \right)$,

Subjected to $\sum_{j=1}^{n} (a_{ij} x_j + d_i^- - d_i^+) = g_i$, where $d_i^-, d_i^+, x_j \geq 0$ and $(i = 1,2 \dots m)$ & $(j = 1,2, \dots n)$

Where d_i^+ is the positive deviation variable from overachieving the i[th] goal; d_i^- is the negative deviation variable from Underachieving the i[th] goal and x_j is the decision variables; a_{ij} is the decision variable coefficient and p_i is the priority level assigned to each relative goal in rank order. The model construction of non-linear goal programming approach involves a square root of sum of the squares of the deviations, where weight is assigned to each goal according to its priority. The goals are inserted in such a way that:

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 3, Issue 4, October 2013

i. Positive deviations with over achievements ($\leq$) need to be minimized

ii. Negative deviations with under achievements ($\geq$) need to be minimized and

iii. Both positive and negative deviations with both under and over achievements (=) need to be minimized. [3], [4], [12], [13].

iv. The brief description of the goals and model is as follows:

Goal 1: The Least cost ration, where deviation d_{lc}^{-} is under achievement and d_{lc}^{+} is over achievement and d_{lc}^{+} is to be minimized.

Goal 2 & 3: Total weight of all ingredients, where deviations d_t^{-} and d_t^{+} are under and over achievement, and both the deviations is to be minimized.

Goal 4: Protein requirement, where deviation d_{cp}^{-} is under achievement and d_{cp}^{+} is over achievement and d_{cp}^{-} to be minimized.

Goal 5: Energy requirement, where deviation d_{tdn}^{-} is under achievement and d_{tdn}^{+} is over achievement and d_{tdn}^{-} to be minimized.

Goal 6: Calcium requirement, where deviation d_{ca}^{-} is under achievement and d_{ca}^{+} is over achievement, and d_{ca}^{-} to be minimized.

Goal 7: Phosphorus requirement, where deviation d_p^{-} is under achievement and d_p^{+} is over achievement, and d_p^{-} to be minimized.

Goal 8: Grain (Maize and Jowar) requirement, where deviation d_g^{-} is under achievement and d_g^{+} is over achievement, and d_g^{+} to be minimized.

Goal 9: Bran (Rice and Wheat) requirement, where deviation d_b^{-} is under achievement and d_b^{+} is over achievement, and d_b^{+} to be minimized.

Goal 10: Cake (Groundnut and Cotton cakes) requirement, where deviation d_{ck}^{-} is under achievement and d_{ck}^{+} is over achievement, and d_{ck}^{+} to be minimized.

Goal 11&12: Roughage and concentrate ratio 2:3, where $d_{\frac{r}{c}}^{-}$ is under achievement and $d_{\frac{r}{c}}^{+}$ is over achievement and both the deviations are to be minimized.

Goal 13&14: Dry green ratio 2:3, where $d_{\frac{d}{g}}^{-}$ is under achievement and $d_{\frac{d}{g}}^{+}$ is over achievement and both the deviations are to be minimized.

Goal 15&16: Legume (cowpea) and no legume (hybrid Napier) ratio 1:1, where $d_{\frac{c}{h}}^{-}$ is under achievement and $d_{\frac{c}{h}}^{+}$ is over achievement and both the deviations are to be minimized.

III. METHODOLOGY

The model construction of non-linear weighted goal programming approach involves square root of sum of the squares of the deviations, where weight is assigned to each goal according to its priority. The optimal compromise solution is found through the philosophy of 'distance measure' that measures the discrepancy between the desired goal and the performance level of a goal. Mathematical model of non-linear weighted sum Goal Programming problem for livestock ration formulation with three different levels of animals is as follows:

Minimize (z) =

$$\sqrt{\begin{array}{c} P_1 d_{lc}^{+2} + P_2 d_t^{-2} + P_3 d_t^{+2} + P_4 d_{cp}^{-2} + P_5 d_{tdn}^{-2} + P_6 d_{ca}^{-2} + P_7 d_p^{-2} \\ + P_8 d_g^{+2} + P_9 d_b^{+2} + P_{10} d_{ck}^{+2} + P_{11} d_{\frac{r}{c}}^{-2} + P_{12} d_{\frac{r}{c}}^{+2} + P_{13} d_{\frac{d}{g}}^{-2} + \\ P_{14} d_{\frac{d}{g}}^{+2} + P_{15} d_{\frac{c}{h}}^{-2} + P_{16} d_{\frac{c}{h}}^{+2} \end{array}}$$

Subjected to:

Priorities	Level 1	Level 2	Level 3
P_1	0.48	2.01	1.17
P_2	0	0	0
P_3	0	0	0
P_4	15.5	-61.5	-0.03
P_5	369	369	221
P_6	-0.62	-0.62	-0.08
P_7	3.408	3.408	3.408
P_8	0	0	0
P_9	0	0	0
P_{10}	0.21	0.21	0.21
P_{11}	0	0	0
P_{12}	0	0	0
P_{13}	0	0	0
P_{14}	0	0	0
P_{15}	0.48	0.48	0.48
P_{16}	0.48	0.48	0.48

Constraints	**Level 1**	**Level 2**	**Level 3**
$4x_1+2x_2+4x_3+10x_4+9x_5+12x_6+12x_7+14x_8+20x_9+d_{1c}^{-}-d_{1c}^{+}$	$\leq$ 7.48	$\leq$9.01	$\leq$8.17
$x_{1+}+x_2+x_3+x_4+x_5+x_6+x_7+x_8+x_9+d$	=1	=1	=1

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 3, Issue 4, October 2013

$_t^{-}$ $-d_t$			
$30x_1+102x_2+180x_3+80x_4+110x_5+120x_6+120x_7+450x_8+300x_9+d_{cp}^{-}-d_{cp}^{+}$	≥ 31	≥ 108	≥ 46.53
$450x_1+550x_2+600x_3+880x_4+850x_4+660x_6+650x_7+790x_8+790x_9+d_{tdn}^{-}-d_{tdn}^{+}$	≥ 297	≥ 693	≥ 445
$2x_1+5.6x_2+12.8x_3+2.7x_4+3x_5+2.4x_6+2.6x_7+3.8x_8+7.4x_9+d_{ca}^{-}-d_{ca}^{+}$	≥ 3.8	≥ 5.15	≥ 3.1
$1.1x_1+3.8x_2+5.7x_3+4.2x_4+3.9x_5+17.3x_6+13.4x_7+8.4x_8+13.2x_9+d_p^{-}-d_p^{+}$	≥ 2.3	≥ 3.78	≥ 2.3
$(x_4+x_5)+d_g^{-}-d_g^{+}$	≤ 0.36	≤ 0.36	≤ 0.36
$(x_6+x_7)+d_b^{-}-d_b^{+}$	≤ 0.30	≤ 0.30	≤ 0.30
$(x_8+x_9)+d_{ck}^{-}-d_{ck}^{+}$	≤ 0.21	≤ 0.21	≤ 0.21
$3(x_1+x_2+x_3)-2(x_4+x_5+x_6+x_7+x_8)+d_{r/c}^{-}-d_{r/c}^{+}$	=0	=0	=0
$3x_1-2(x_2+x_3)+d_{d/g}^{-}-d_{d/g}^{+}$	=0	=0	=0
$(x_2-x_3)+d_{c/h}^{-}-d_{c/h}^{+}$	=0	=0	=0

Where the priorities of the goals for level 1, 2 and3 are as mentioned below:

IV. GENETIC ALGORITHM

Genetic Algorithms (GAs) are adaptive heuristic search algorithm based on the evolutionary ideas of natural selection and genetics. Based on the principles first laid down by Charles Darwin of "survival of the fittest", GAs simulates the survival of the fittest among individuals over consecutive generation for solving a problem. Each generation consists of a population of character strings that are analogous to the chromosome that we see in our DNA. Each individual represents a point in a search space and a possible solution. The individuals in the population are then made to go through a process of evolution. Gas is based on an analogy with the genetic structure and behaviour of chromosomes within a population of individuals using the following foundations:

- Individuals in a population compete for resources and mates.
- Those individuals most successful in each 'competition' will produce more offspring than those individuals that perform poorly.
- Genes from `good' individuals propagate throughout the population so that two good parents will sometimes produce offspring that are better than either parent.

Thus the each successive Generation will become more suited to their environment.

V. AN IMPLEMENTATION

A. *Based on Natural Selection*

After an initial population is randomly generated, the algorithm evolves through three operators:

1. **Selection** which equates to survival of the fittest;
2. **Crossover** which represents mating between individuals;
3. **Mutation** which introduces random modifications.

B. *Selection Operator*

- Preference is given to better individuals, allowing them to pass on their genes to the next generation.
- The goodness of each individual depends on its fitness.
- Fitness may be determined by an objective function or by a subjective judgment.

C. *Crossover Operator*

- Prime distinguished factor of GA from other optimization techniques
- Two individuals are chosen randomly from the population using the selection operator, and changing the bits of the same sections of two individuals
- The two new offspring created from this mating are put into the next generation of the population
- By recombining portions of good individuals, this process is likely to create even better individuals

D. *Mutation Operator*

- For the individual to mutate, randomly choosing the point to mutate which means the bit of the individual encoded binary string, then change 0 to 1 and change 1 to 0.
- Pm is the probability of mutation so with some low probability, a portion of the new individuals will have some of their bits flipped. A number of probabilities of mutation are randomly given by the computer. If the given number is not greater than pm, the individual mutates, otherwise don't mutate.
- Its purpose is to maintain diversity within the population and inhibit premature convergence.

Although genetic algorithm cannot always provide optimal solution; it has its own advantages and is a powerful tool for solving complex problems. [1], [2], [5], [8], [9], [14] In this paper an attempt is made to solve the Goal programming problem with non linear objective function, by Genetic algorithm since GA is problem independent, probabilistic and can handle any kind of objective function and any kind of constraints due to its evolutionary nature. To solve weighted sum non linear Goal programming model by GA , Variables are first coded in binary string structures where length of the

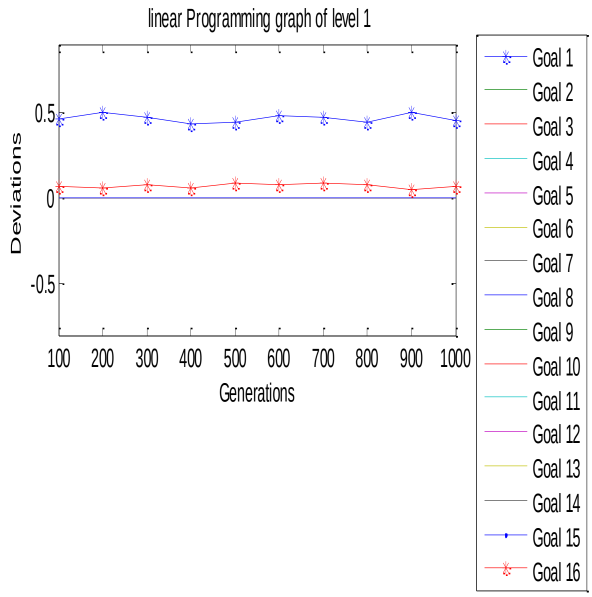
ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 3, Issue 4, October 2013

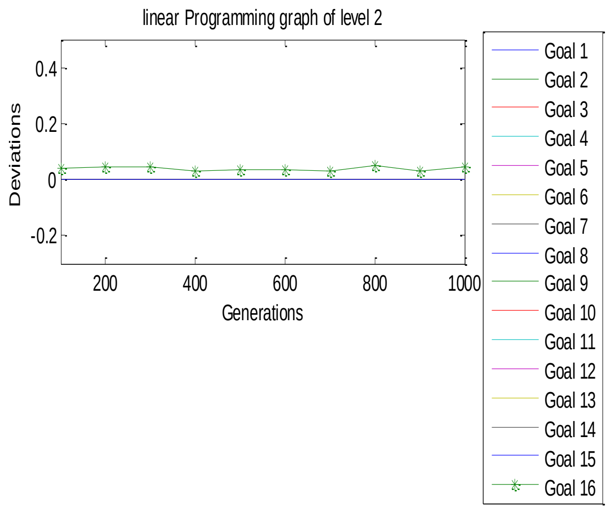
strings are chosen according to desired solution accuracy , which gives us the set of population of random strings, then the string is evaluated to find its fitness value. The population is then operated in three main operators (as mentioned above) – selection, crossover, mutation procedures to create another new set of populations. The said procedure is repeated through GA operators until the individuals with low fitness score in the population die and better solutions thrive over successive generations [5], [6], and [10]. So the given set of Model is evaluated for 1000 generations with 50-population size.

VI. RESULTS AND DISCUSSION

The non linear programming model is solved in Genetic algorithm for 1000 generations for level 1, 2 and 3, and the result obtained is given in table 1 and 2 of Linear and Non-linear Programming model. Also the comparison of Controlled Random search technique and Genetic algorithm for Non-linear Goal programming Problem of Level 1, 2 and 3 is shown in table 3. The present paper focuses on Heuristic approach for optimization of ration of Indian dairy cows with 10 Litre of daily milk yield, considering non-linear weighted sum Goal programming formulation. GA approach is reflected as better approach in solving non- linear Goal Programming problems in comparison with the earlier approaches. In the earlier work by Shrabani [13] the linear Goal programming problem was solved using excel solver. An attempt has been made in the present study to extend the linear GPP as non-linear weighted sum Goal programming with pre-defined priorities at different levels and is solved using Genetic Algorithm approach. Jothi Laksmi [12] also made an attempt to solve this problem by controlled random search technique (RST). The comparison from Table 3 and Figure 3 shows that GA approach gives better results as compared to RST. It is also noticed from the results shown in table 1 that Goal 1 is over achieved by 46 % to 50% of variation and Goal 15 is overachieved by 5% to 8.5% of variation for Level 1. In level 2 Goal 16 is overachieved by 3.2% to 4.7% of variation. Also in level 3 Goal 1 is over achieved by 42.6% to 50.9% of variation. All other Goals are achieved in Thousand Generations using GA for Linear model. Figure 1 can be referred to see the wholistic view of the goals achievement. From Fig.2 we can see that Goal 1 is over achieved by 16.2% to 20.2% of variation and Goal 15 is over achieved by 14.9% to 21.3% of variaton for level 1. In Level 2 all the Goals are achieved and for level 3 Goal 1 is over achieved by 46% to 51.8% of variation, Goal 16 is overacheived by 5% to 10% of variation. All other Goals are achieved in 1000 generations using GA for non-linear model. Figure 2 can be referred to see the wholistic view of the goals achievement.

Fig.1 Graphs of Deviations for linear model of Level1, 2, *3*





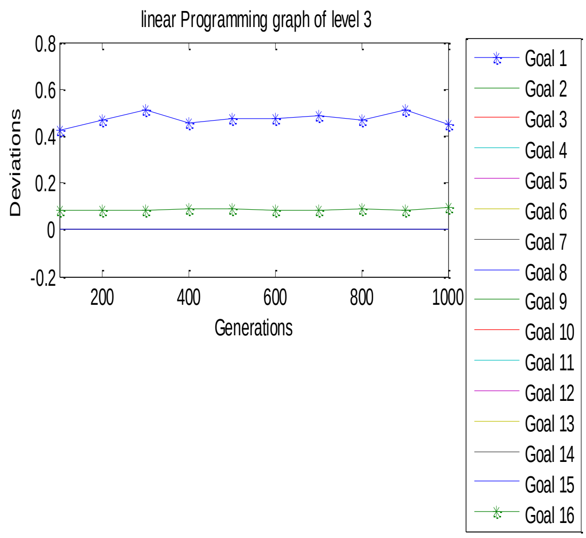
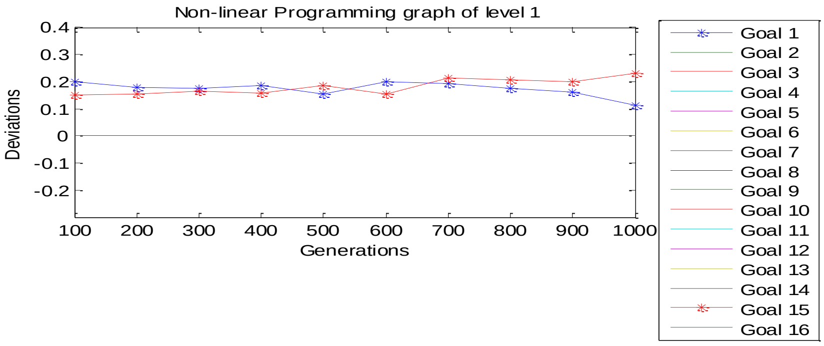
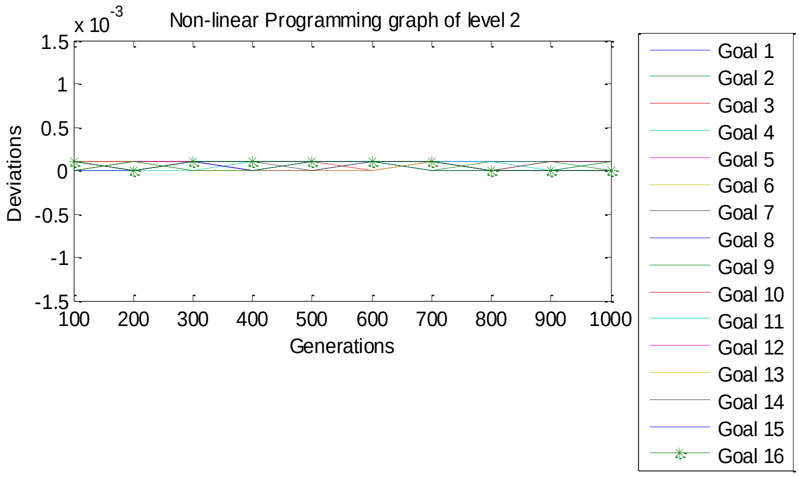
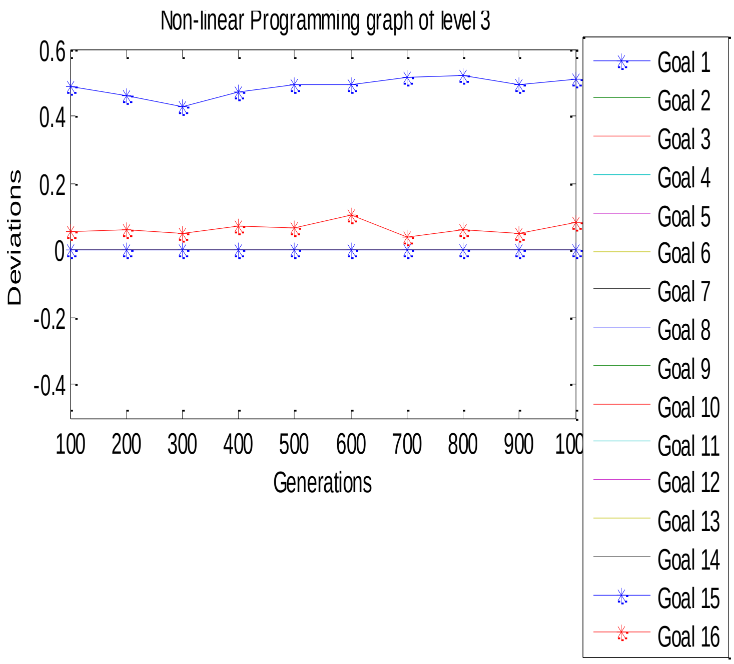


Fig.2 Graphs of Deviations for Non- linear model of Level1, 2, 3

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 3, Issue 4, October 2013







IJEIT

ISSN: 2277-3754

ISO 9001:2008 Certified

International Journal of Engineering and Innovative Technology (IJEIT)

Volume 3, Issue 4, October 2013

Table1: Solution of linear Programming Problem of level 1,2and 3

1 \ 2		X1	X2	X3	X4	X5	X6	X7	X8	X9	Obj Fun
100	**Level 1**	0.1174	0.0465	0.1002	0.0001	0.2384	0.0000	0.2627	0.0001	0.0001	**0.2784**
	Level 2	0.0819	0.0638	0.0813	0.0000	0.3225	0.0001	0.0278	0.0000	0.1000	**0.0134**
	Level 3	0.0649	0.0396	0.0422	0.0000	0.3142	0.0000	0.2633	0.0001	0.0001	**0.5578**
200	**Level 1**	0.0678	0.0429	0.0718	0.0001	0.3336	0.0001	0.2201	0.0000	0.0001	**0.2861**
	Level 2	0.064	0.0367	0.0959	0.0001	0.3338	0.0001	0.0155	0.0000	0.0623	**0.0149**
	Level 3	0.093	0.0381	0.0995	0.0000	0.2960	0.0001	0.2378	0.0000	0.0000	**0.586**
300	**Level 1**	0.0664	0.0289	0.1258	0.0001	0.3253	0.0001	0.2831	0.0001	0.0000	**0.2814**
	Level 2	0.0599	0.0394	0.0516	0.0001	0.3175	0.0000	0.0228	0.0001	0.1155	**0.0159**
	Level 3	0.0775	0.0518	0.0857	0.0001	0.2855	0.0000	0.2477	0.0000	0.0000	**0.6303**
400	**Level 1**	0.0756	0.0327	0.0741	0.0001	0.2387	0.0000	0.2286	0.0000	0.0001	**0.2656**
	Level 2	0.0834	0.0509	0.0648	0.0000	0.3389	0.0001	0.0312	0.0000	0.0539	**0.0102**
	Level 3	0.0930	0.0381	0.0995	0.0000	0.2960	0.0001	0.2378	0.0000	0.0000	**0.5860**
500	**Level 1**	0.1039	0.0311	0.0758	0.0001	0.2815	0.0000	0.2605	0.0001	0.0001	**0.2852**
	Level 2	0.0534	0.0538	0.1118	0.0001	0.3261	0.0000	0.0194	0.0001	0.0849	**0.0136**
	Level 3	0.0378	0.0299	0.1477	0.0001	0.2983	0.0000	0.2648	0.0001	0.0000	**0.6098**
600	**Level 1**	0.1027	0.0362	0.0943	0.0000	0.3287	0.0001	0.2692	0.0000	0.0001	**0.2767**
	Level 2	0.1106	0.0547	0.0655	0.0001	0.3572	0.0000	0.0269	0.0001	0.0957	**0.0113**
	Level 3	0.0903	0.0428	0.1197	0.0001	0.3174	0.0000	0.2262	0.0000	0.0001	**0.6064**
700	**Level 1**	0.0961	0.0289	0.0683	0.0001	0.2651	0.0000	0.2309	0.0001	0.0000	**0.2782**
	Level 2	0.0803	0.0507	0.1096	0.0001	0.2991	0.0001	0.017	0.0001	0.1074	**0.0119**
	Level 3	0.1154	0.0427	0.0837	0.0001	0.3460	0.0001	0.2506	0.0000	0.0000	**0.6247**
800	**Level 1**	0.0873	0.0486	0.152	0.0000	0.2806	0.0001	0.2371	0.0000	0.0000	**0.2629**
	Level 2	0.1191	0.0524	0.0752	0.0000	0.3464	0.0000	0.0285	0.0000	0.0612	**0.0183**
	Level 3	0.0857	0.0379	0.1244	0.0000	0.2960	0.0001	0.2427	0.0000	0.0001	**0.5931**
900	**Level 1**	0.0667	0.0486	0.0889	0.0001	0.3224	0.0001	0.2772	0.0001	0.0001	**0.2864**
	Level 2	0.0700	0.0713	0.0983	0.0001	0.3084	0.0000	0.0182	0.0001	0.0623	**0.0116**
	Level 3	0.0311	0.0461	0.0794	0.0000	0.3150	0.0000	0.2284	0.0000	0.0001	**0.6406**
1000	**Level 1**	0.072	0.1931	0.0000	0.0001	0.2161	0.0001	0.1529	0.0000	0.0000	**0.2014**
	Level 2	0.1028	0.0545	0.0876	0.0001	0.3411	0.0000	0.0237	0.0000	0.0230	**0.0167**
	Level 3	0.1124	0.0386	0.096	0.0001	0.2928	0.0000	0.2267	0.0000	0.0000	**0.4880**

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 3, Issue 4, October 2013

Table2: Solution of Non- linear Programming Problem of level 1,2and 3

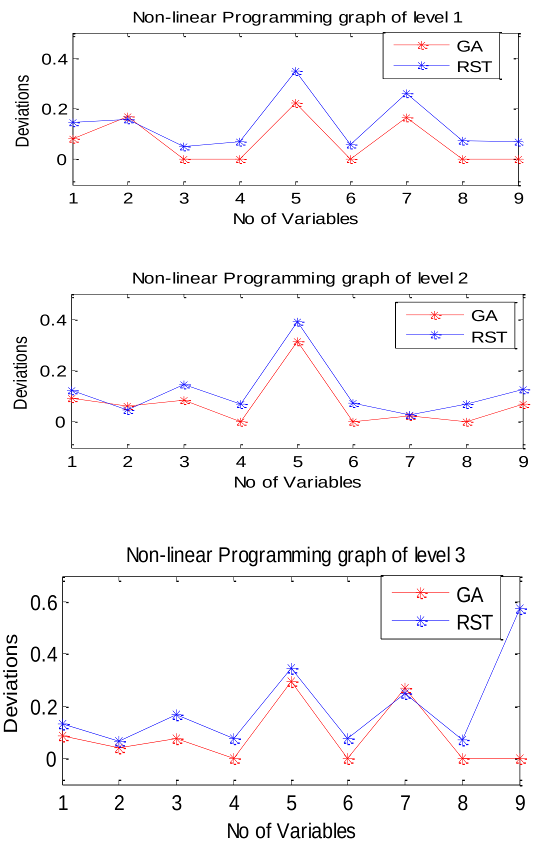
1 \ 2		X1	X2	X3	X4	X5	X6	X7	X8	X9	Obj Fun
100	**Level 1**	0.0997	0.1663	0.0001	0.0000	0.2464	0.0001	0.1451	0.0001	0.0000	**0.1736**
	Level 2	0.1334	0.0589	0.0786	0.0001	0.3558	0.0001	0.0258	0.0000	0.0964	**0.0227**
	Level 3	0.0507	0.035	0.0926	0.0000	0.3421	0.0001	0.2617	0.0001	0.0000	**0.5279**
200	**Level 1**	0.0555	0.1887	0.0000	0.0000	0.2527	0.0000	0.1319	0.0001	0.0000	**0.1637**
	Level 2	0.0641	0.0709	0.1129	0.0001	0.3523	0.0000	0.0236	0.0000	0.0885	**0.0268**
	Level 3	0.0601	0.0415	0.1002	0.000	0.2765	0.0001	0.2651	0.0000	0.0000	**0.4996**
300	**Level 1**	0.0937	0.1617	0.0001	0.0000	0.2307	0.0001	0.1974	0.0001	0.0001	**0.1664**
	Level 2	0.063	0.0688	0.1222	0.0001	0.3522	0.0000	0.0177	0.0000	0.0761	**0.0203**
	Level 3	0.0872	0.0416	0.0825	0.0001	0.2607	0.0001	0.248	0.0000	0.0001	**0.4663**
400	**Level 1**	0.0993	0.2019	0.0000	0.0000	0.2145	0.0000	0.1338	0.0000	0.0001	**0.1694**
	Level 2	0.1012	0.0544	0.0499	0.0001	0.2953	0.0001	0.0259	0.0000	0.0692	**0.0266**
	Level 3	0.0859	0.0444	0.0466	0.0000	0.3256	0.0001	0.249	0.0000	0.0000	**0.5114**
500	**Level 1**	0.1078	0.1863	0.0001	0.0000	0.2165	0.0000	0.1772	0.0001	0.0000	**0.1683**
	Level 2	0.0634	0.0685	0.0807	0.0000	0.2852	0.0000	0.0189	0.0000	0.0372	**0.0251**
	Level 3	0.1182	0.0428	0.0476	0.0001	0.2555	0.0000	0.2565	0.0000	0.0001	**0.5380**
600	**Level 1**	0.0926	0.1887	0.0000	0.0000	0.2779	0.0000	0.1926	0.0000	0.0001	**0.1763**
	Level 2	0.1043	0.0809	0.1079	0.0001	0.3287	0.0000	0.0286	0.0001	0.102	**0.0288**
	Level 3	0.1144	0.0463	0.0846	0.0001	0.3406	0.0001	0.2685	0.0000	0.0000	**0.5355**
700	**Level 1**	0.0677	0.1597	0.0001	0.0001	0.2192	0.0001	0.2000	0.0000	0.0001	**0.1999**
	Level 2	0.0551	0.0469	0.113	0.0001	0.3354	0.0001	0.0283	0.0001	0.0707	**0.0229**
	Level 3	0.0821	0.0517	0.1025	0.0001	0.2517	0.0001	0.2625	0.0001	0.0001	**0.5562**
800	**Level 1**	0.0360	0.1712	0.0000	0.0000	0.2266	0.0000	0.1605	0.0001	0.0001	**0.1872**
	Level 2	0.1227	0.0626	0.1185	0.0001	0.3737	0.0000	0.026	0.0001	0.0859	**0.0290**
	Level 3	0.087	0.0303	0.0938	0.0000	0.3116	0.0001	0.2392	0.0000	0.0000	**0.5628**
900	**Level 1**	0.1273	0.1365	0.0001	0.0000	0.1936	0.0000	0.1799	0.0000	0.0000	**0.1779**
	Level 2	0.1248	0.0746	0.1132	0.0001	0.3462	0.0001	0.0182	0.0001	0.0541	**0.0273**
	Level 3	0.0768	0.0368	0.0492	0.0000	0.3277	0.0001	0.2500	0.0000	0.0001	**0.5319**
1000	**Level 1**	0.1100	0.1518	0.0000	0.0001	0.2559	0.0000	0.2026	0.0001	0.0001	**0.1793**
	Level 2	0.0531	0.0553	0.0805	0.0001	0.2536	0.0001	0.0252	0.0000	0.0409	**0.0270**
	Level 3	0.0903	0.0328	0.0863	0.0000	0.2893	0.0001	0.2727	0.0000	0.0000	**0.5520**

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 3, Issue 4, October 2013

Table3: Comparission Table for Non-linear programming problem

GA			RST		
Level 1	**Level 2**	**Level 3**	**Level 1**	**Level 2**	**Level 3**
0.0360-0.1273	0.0531-0.1334	0.0507-0.1182	0.1-0.196	0.102-0.146	0.102-0.158
0.1365-0.2019	0.0469-0.0809	0.0303-0.0517	0.101-0.216	0.027-0.068	0.055-0.077
0.0000-0.0001	0.0499-0.1185	0.0466-0.1025	0.017-0.084	0.141-0.153	0.150-0.187
0.0000-0.0001	0.0000-0.0001	0.0000-0.0001	0.052-0.088	0.062-0.076	0.055-0.098
0.1936-0.2559	0.2536-0.3737	0.2517-0.3421	0.309-0.386	0.314-0.389	0.301-0.395
0.0000-0.0001	0.0000-0.0001	0.0000-0.0001	0.050-0.068	0.059-0.086	0.057-0.095
0.1319-0.2026	0.0177-0.0286	0.2727-0.2685	0.204-0.318	0.012-0.047	0.201-0.299
0.0000-0.0001	0.0000-0.0001	0.0000-0.0001	0.059-0.089	0.050-0.087	0.050-0.088
0.0000-0.0001	0.0409-0.0964	0.0000-0.0001	0.050-0.088	0.101-0.153	0.50-0.649

Fig.3 Graph for Comparison of GA and RST



VII. CONCLUSION

The objective of this paper is to present how genetic algorithm could be applied to support optimization of daily management tasks in the dairy sector. The algorithm was tested at three different levels for dairy cows with a 10 Litre daily milk yield. The results obtained confirm the benefits of the applied approach. In contrast to the common linear program tools, which terminate at formulation of the least-cost ration, our tool provides more efficient rations by fine-tuning the nutritive goals and by allowing for harmless deviations from these goals by introducing under achievement & over achievement.With the applied approach to non-linear weighted goal programming problem, we have tested how the 'optimal' ration would change due to different preferences concerning the cost goal. The applied approach proves to be a useful 'engine' which enables one to formulate close to least-cost ration, not taking a too high a risk of worsening the ration's nutritive value, which is the main common drawback of the LP. Rations can further be improved with fine-tuning of the target values of the goals. The developed tool might be useful also for the assessment of consequences due to globalization impacts (input price rise, price volatility, and environmental as well as climate change aspects) by preparing calculations for different situations

REFERENCES

[1] Abdul Kadar Muhammad Masum, International Journal of Advanced Computer Science and Applications, Vol. 2, No. 7, 20.

[2] Cheng Guo and Xiaoyong Yang, February .2011." A Programming of Genetic Algorithm in Matlab7.0" Vol. 5, No. 1, Modern Applied Science.

[3] D.W. Zheng et al, Evolution Program for Nonlinear Goal Programming, 18th International Conference on Computers and Industrial Engineering.

[4] Ekezie Dan Dan etal, " Goal Programming: - An Application To Budgetary Allocation Of An Institution Of Higher Learning", Research Journal in Engineering and Applied Sciences 2(2) 95-105, 2013 (ISSN: 2276-8467).

[5] G.N Purohit, Arun Mohan Sherry and Manish Saraswat, "Optimization of Function by using a New MATLAB based Genetic Algorithm Procedure", Volume 61– No.15, January 2013.

[6] Kalyanmoy Deb,"Optimization for Engineering Design ", ISBN-978-81-203-0943-2, May 2009.

[7] Mohan and Deep, K.2009. 'Optimization techniques', New Age International Publishers.

[8] Mitsuo Gen and Runwei Cheng, "Genetic Algorithm and Engineering Design", ISBN 0-471-12741-8, john Wiley and son Pratibha bajpai and Dr. Manoj Kumar. "Genetic Algorithm – an Approach to Solve Global Optimization Problems", Vol 1 No 3 199-206.

[9] Papun Biswas etal, Genetic Algorithm Based Goal Programming Procedure for Solving Interval-Valued

ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 3, Issue 4, October 2013

Multilevel Programming Problems, International Journal of Advanced Computer Research (ISSN (print): 2249-7277 ISSN (online): 2277-7970) Volume-3 Number-1 Issue-8 March-2013.

[10] Radha G. and Manasa J. 2013. Use of “Controlled Random Search Technique for Global Optimization” in Animal Diet Problem, International Journal of Emerging Technology and Advanced Engineering, ISSN 2250-2459, Volume 3, Issue 2,..

[11] Radha G. Jothi Lakshmi. and Manasa J. September, ‘A Study of Livestock Ration Formulation using Goal Programming and Random Search Technique for Global Optimization’

[12] Shrabni Gosh, M.Phils dissertation, unpublished September 2011,' Least Cost Ration formulation in animal using Mathematical modeling: an integrated linear and weighted Goal Programming approach, Jain University.

[13] S.N.Sivanandam, S.N. Deepa, Introduction to Genetic Algorithms, ISBN 978-3-540-73189-4 Springer Berlin Heidelberg New York 2008.

[14] Saxena Pratiksha, Vinay Pathak, Vinod Kumar. September, 2012 "Animal Feed Formulation Using Non-Linear Programming and MATLAB", OMICS.

AUTHOR’S PROFILE

Dr. Radha Gupta, a faculty of Mathematics at School of Engineering and Technology, Jain University, Bangalore, is continuously engaged in teaching and research activities for past 17 years. Her area of specialization is Operations Research. And she has published many papers in peer reviewed National and International Journals. She is a recipient of President Gold Medal from Agra University and University Gold Medal from IIT Roorkee.

.

Ravinder Singh Kuntal is working as Assistant Professor in the Department of Mathematics at School of Engineering and Technology, Jain University, Bangalore, Karnataka (India). He has passed his Masters in Mathematics from Central College, Bangalore University, Karnataka, and he has 2.5 years of Teaching Experience with one international publication in peer reviewed journal .He is pursuing PhD under the guidance of Dr Radha Gupta. His research area is Operational Research.

Kokila Ramesh, a faculty of Mathematics at School of Engineering and Technology, Jain University, Bangalore, is continuously engaged in teaching and research activities for past 10 years. Her area of specialization is Random process modeling. And she has published two papers in peer reviewed National Journal. She is pursuing her PhD from Jain University**.**