UDC 636.085.55.4

PROBABILISTIC MODEL OF COMPOUND ANIMAL FEEDSTUFF MIXING PROCESS

I.I.Dudarev, cand.tech.sci.
Odesa State Agrarian University

The process of mixing of compound animal feedstuff components for any amount of space of working area of the mixer, irrespective by its construction and operation principle can be presented on the basis of the terms of probabilistic evolution process.

Key words: compound animal feedstuff, analysis, dependence, efficiency, probability.

Introduction. The main technological operations of compound animal feedstuff production are: grinding, classification, mixing and compaction. Each previous operation of the technological process should create sufficient conditions for optimal fullfilment of the next continuous operation cycle considering possible quality of the final product.

Problem. Ordinariness and lack of aftereffect allow to describe the number of unit doses of the mixture components that come in the elementary volume of the working area, by Poisson distribution. The probability of the state of multicomponent system in general, without considering of phenomena of returning flows and their mutual redistribution that take place in any of the current mixer model are described with the equations.

Analysis of recent researches and publications. The requirement for homogeneity of feedstuff in recent years has increased due to the recipes complexity, including more components, it does not play a special role, if the components get into the feed stuffs directly from the mixer, or with the premix. It is known that the homogeneity of feedstuff for chickens and pigs of early age is the important factor affecting the growth and feed intake. Animals of older age consume more food, which lingers longer in the gastrointestinal tract, so they are less sensitive to its composition. From the practical point of view, the coefficient of variation of feedstuff composition, at 5%, is achievable. It is particularly important to distribute in the mass of feedstuff components that exist in small quantities, with high feeding value, or biological activity. Homogeneity is important because the daily diet, especially one-time delivery of feed to the animals, particularly birds, is very small. In some cases, it is calculated by several tens of grams. And in this small amount of feed should to be all substances provided by feedstuff ration, premixes and so on. The homogeneity of components distribution is provided by mixing them, so we suggest to predict the quality of the final mix by probabilistic indicators.

The purpose of the study. Determination of the homogeneity of the compound animal feedstuff mixture is based on probabilistic interpretation of the mixing process.

Results. The process of feedstuff components mixing for any amount of space of working area of the mixer, irrespective by its construction and operation principle can be considered, on the basis of the conditions of the probabilistic evolution for determination of the homogeneity of the compound animal feedstuff mixture based on probabilistic interpretation of the mixing process. Analysis of the mixing conditions [1, 2] allows to consider process as the flow of events of transition from one state to another at random time with some intensity. Finding mixture component in any amount of working area is characterized by Poisson flow properties. Assuming a vary small amount of probable appearance of two or more doses at elementary infinitesimal time interval, the probability of formation of one dose, the flow of events can be considered ordinary, based on the independence of the probable appearance of elementary doses of mixing components disjoint time intervals that characterize flow of events. Ordinariness and lack of aftereffect allow to describe the number of unit doses of the various mixture components that exist in the elementary volume of the working area, by Poisson distribution. The probability of state of the multicomponent system in general, without considering return flow phenomena, as well as mutual redistribution that take place in any mixer model are described by the equations:

$$\frac{dp}{dt} = -\lambda p \tag{1}$$

$$\frac{dp}{dt} = \Sigma \lambda p \tag{2}$$

the initial conditions:

$$p(0) = k_i \tag{3}$$

$$i = 1,2.3, \ldots n \tag{4}$$

$$\Sigma k_i = 1 \tag{5}$$

where λ – density events flow equally reflect the dynamics of the distribution of the main components of animal feedstuff mixtures in obtained areas of samples; k_i - the probability that are set by input parameters in compliance with components distribution ; n - number of components.

In order to obtain empirical values of flow components intensity the sequence of time points t_0, t_1, t_2 ... t_n is given, then the sample from v space of the working area of the mixer is taken. In each sample the mass of the mixture components was determined and parameters λ were calculated by the formula:

$$\lambda = \frac{m_2 - m_1}{t_2 \quad t_1} = \frac{\Delta m}{\Delta t} \tag{6}$$

where the change of component concentration by time t, corresponds to the theoretical value of the Poisson distribution parameter:

$$a = \lambda \tag{7}$$

Then the average values for each space of the working area of the mixer respectively were determined by the formulas:

$$\gamma s = 1 / N; \quad (8)$$

$$\gamma = 1 / v\ \gamma s \quad (9)$$

where s - number of sample areas: 1 = 1, 2, 3, ... v.

After determination of the parameters with the formulas (8, 9) probabilities are solutions of system (1).These functions describe the process of the feedstuff mixing . The description of homogeneity in mixture in one indicator estimating can be represented by the equation:

$$P(t) = 1\text{-}ke\text{-}\gamma_i t \quad (10)$$

whereγ_i -generalized coefficient that determines the intensity of the mixing process;

k- coefficient that takes into account the ability of the components to mix.

Conclusions. Production of compound animal feedstuff of various prescription using n components that form the final state according to the requirements of the mixture may be based on the probability that are set by input parameters according to corresponding distribution components.

REFERENCES

1. Braterskiy F.D., Dudarev I.I., Matvienko M.A. Experience of application of methods of estimation of maintenance of vitamins in compound animal feedstuff. – CNII mixed fodder industry. – M.: 1981, p. 3.4.

2. Dudarev I.I., Braterskiy F.D. Increase of efficiency of mixing of compound animal feedstuff components. Survey information. – M.: 1981, c.32.35.

3. Estimation of results of storage of the friable mixed fodders. Agrarian announcer of Prichernomor'ya, collection of scientific labours, Engineerings sciences. Issue. IU19. Odessa, 2001- 196 c. c.77...82.

ВЕРОЯТНОСТНАЯ МОДЕЛЬ ПРОЦЕССА СМЕШИВАНИЯ КОМБИКОРМОВ

Дударев И.И.

Ключевые слова: комбикорм, анализ, зависимость, эффективность, вероятность.

Резюме

Процесс смешивания компонентов комбикормов для любого объема трехмерного пространства рабочей зоны смесителя, независимо от его конструкции и принципа действия, может быть представлен, исходя из условий вероятностной эволюции.

PROBALISTIC MODEL OF THE MIXING PROCESS FODDER

Dudarev I.I.

Key words: *feed, analysis, dependence, efficiency, probability.*

Summary

The process of mixing of compound animal feedstuff components for any amount of space of working area of the mixer, irrespective by its construction and operation principle can be presented on the basis of the terms of probabilistic evolution process.