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Statistical Analysis of Growth Increase in Semi-intensive Broiler Breeding

Bogosavljevic-Boskovic[1] Snežana, I. Gajic [2]
M. Petrovic, V. Bogdanovic [2]

[1] *Faculty of Agronomy, Čačak, Yugoslavia*
[2] *Faculty of Agriculture, Beograd - Zemun, Yugoslavia*

Abstract: This paper was aimed at finding possibilities and reasons for using semi-intensive broiler breeding. The analysis was made on the hybrid Hybro. Despite very similar breeding and dietary conditions, the chickens showed entirely differing growth.The only reason for this was not the variation coefficient, since it ranged within allowable boundaries in most variants. In search of further reasons, a detailed analysis was made computing the lower, upper and inter-quarter difference. All the analyses indicated an expressed scattering of the variants, which increased with body mass increase. In addition to mainly distributed variants in the lower quarter, suggesting generally low fattening results, a highly differing growth of the broilers reflected their unsuitability for industrial slaughter and carcass processing. Therefore, it is still doubtful whether semi--intensive breeding of the broilers, selected for intensive one, can prove efficient. Poultry science is assigned to create hybrids to fit in outlet rearing as well as to select broilers in such a manner that their less differing growth may be expected.

Key words: broilers, semi-intensive breeding, growth increase, brood uniformity, variability

Introduction

Over the years, as a field of animal husbandry, poultry science has increasingly been intensified and industrialized and great success has been met with. However, the questions of whether or not intensive production is justified, primarily concerning meat quality, breeding sustainability, profitability of investment in this production, erecting huge poultry objects and environmental concerns, have not been solved yet. Whatever the problem may be, semi-intensive breeding programmes can be promising only if the problem-solving is attempted on a broad scientific and expert level, which is in agreement with numerous results (Pavlovski Zlatica and Mašić, 1990; Bogosavljević-Bošković Snežana, 1994). A new research field is opened to help poultry production boost and some new approaches in science and practice.

Of all factors influencing outlet broiler breeding, the possibilities and reasons for using semi- intensive breeding manner, are assumed to be of greatest importance, to which more attention will be paid in the future. All statistical indicators of broiler growth were thoroughly investigated to assess whether or not semi-intensive breeding may be efficient with hybrids selected for intensive one.

Material and Methods

At the beginning of the experiment, 200 one-day old broilers of Hybro line were analysed for growth dynamics. During the first two weeks, the broilers were bred as usual, using a thick mat. The outlets intended for semi-intensive breeding were provided later.The available floor surface enabled broiler density of 7 head per meter square. Two feed mixtures were used, initial (with 21 % proteins) until 28th day of age, and final (with 18% proteins) between 28th and 49th day of age when fattening completed.

Fattening characteristics were regularly controlled during the experiment. The first measurement was made on 1-day old, then on 14-day old broilers carrying on weekly until fattening completion. Each broiler was labelled at the beginning of the trial. Sex determination by external features and final body mass measurement, were made at the end of the experiment. Males and females were individually measured 7 times computing the mean and variation value. Standard deviation and variation coefficient were calculated and variance homogeneity examined. The minimum and maximum values, the variation range and median were computed, too.

For clarity, some other parameters were also included, primarily the coefficients of asymmetry and flatness, followed by calculations of the lower, upper and inter-quarter difference, the values of which were compared to those of the variation range. Statistical formulae were employed to make the analysis easier. (Snedecor and Cochorn, 1971. Hadživuković, 1991.).

Results and Discussion

The measurement of growth variability in Hybro broilers was made weekly, computing parameters from Tab.1. and 2.

As can be seen in Tab. 1, the average body mass steadily increased from measurement to measurement, with the highest increase detected between I and II mesurement. In addition, each new measurement indicated that body mass increased more in males than in females. The effect of sex was found to be at the level of statistical significance of 5% in the fisrt, and 1% in the other measurements.

Tab.1. - The values of the average body mass based on weekly measurements and basic variability indices in Hybro broilers

		Measuring						
		I	II	III	IV	V	VI	VII
	☒	39.57	247.35	446.96	739.99	1071.3	1434.3	1718.9
	sd	3.30	23.11	56.92	73.26	139.23	195.73	212.58
Male	cv	8.37	9.34	12.73	9.90	12.99	13.65	12.37
n=100	min	31	186	318	572	765	1020	1300
	max	46	288	565	920	1360	1810	2130
	min-max	15	102	247	348	595	790	830
	☒	38.56	231.68	420.23	690.71	985.43	1326.6	1549.7
	sd	3.02	23.87	49.90	60.05	116.64	146.95	152.35
Female	cv	7.84	10.30	11.87	8.69	11.84	11.08	9.83
n=93	min	30	162	282	532	740	980	1190
	max	44	278	520	840	1265	1680	1870
	min-max	14	116	238	308	525	700	680
	t	2.22*	4.62**	3.48**	5.13**	4.66**	4.34**	6.39**
	F	1.19	1.07	1.30	1.49*	1.42*	1.77**	1.95**

The differences in body mass were analysed using some basic indicators, i.e. standard deviation and variation coefficient. The highest value of the variation coefficient was recorded in VI (13,646) with males and in III (11,874) measurement with females. The other measurements displayed somewhat lower values of the variation coefficient, but ranging within permissible boundaries. With the exception to II measurement, the other ones showed considerably lower values of the variation coefficient in females, compared to those in males.

The results of variance homogeneity, obtained by successive measurements for both sexes, enabled us to conclude that, during first three measurements, in contrast to the mean values, those of variability were below the limit, ie. unaffected by sex. In the next measurements, no homogeneity was felt due to significant differences existing between the sexes in IV and V (P*) and highly significant ones (P**) in VI and VII mesurement.

Other statistical parameters, primarily, the minimum and maximum values, as well as the variational range also helped to analyse the variabilty, i.e. variant distribution (Tab. 1).

The minimum values appeared to be characteristically lower in males than in females throughout all the measurements. Up to III and, to a certain extent, to IV measurement, the minimum values steadily doubled with the following measurement, compared to the preceding one. In one word, the higher broiler body mass was, the higher variant scattering, was.

The maximum values behaved analogously to the minimum ones, meaning their steady increase in males contrary to females. These values increased in II compared to I, to gradually decrease with each next measurement until the last one, when a sudden drop occurred.

The minimum and maximum values highly influenced variation range, which increased with each next measurement, exhibiting higher and higher values in males, but lower and lower ones in females. The variation range increased most in II compared to I, i.e. sevenfold in both sexes, then in III compared to II, i.e. twofold, only slightly in VII compared to VI, to eventually decline in the last measurement, compared to the preceding one.

Some other indicators presented in the Tab. 2. were also calculated to help thoroughly analyse all statistical parameters.

Tab. 2. - The data of the central tendency and the indices of a detailed analysis of the variant distribution

Mea-suring	Me	β_1	β_2	Q_{25}	Q_{25}-min	Q_{75}	max-Q_{75}	Q_{75}-Q_{25}	$(Q_{75}$-$Q_{25})/4+Me/2$
	Male								
I	40	0.018	2.316	37	6	43	3	6	21.5
II	252	0.106	2.562	229	43	266	22	37	135.25
III	465	0.190	2.618	415	97	485	80	70	250
IV	755	0.014	2.857	690	118	780	140	90	400
V	1110	0.077	2.278	965	200	1170	190	205	606.25
VI	1477.5	0.050	2.257	1295	275	1575	235	280	808.75
VII	1755	0.012	2.104	1550	250	1870	260	320	957.5
	Female								
I	38	0.000	2.534	37	7	41	4	4	20
II	232	0.202	3.141	218	56	247	31	29	123.25
III	430	0.283	2.715	380	98	457	63	77	243.25
IV	705	0.061	2.769	646	114	730	110	84	373.5
V	985	0.007	2.514	905	165	1065	200	160	532.5
VI	1310	0.000	2.497	1220	240	1440	240	220	710
VII	1540	0.010	2.297	1440	250	1670	200	230	827.5

Analysing the data from Tab.2., one can say that in all the measurements except II, the median proved higher than the average in male broilers, exceeding it most in VI measurement i.e. by 43,2 g. In the females, the median seemed generally higher than the average in I, V, VI and VII measurement, approximating it (the difference of only 0,43 g) in V, but highly deviating from it in VI measurement (the difference of 16,5 g).

However, these statistical parameters provided only a rough picture so that some more specific ones were calculated to make variant distribution analysis easier.These are asymmetry coefficients (β_1). Due to its extremely low values, asymmetry was first scarcely, then moderately present, which may be accounted for by the coefficients frequency from -2 to 2 . Nevertheless, asymmetry coefficient reached its peak in III measurement in both males and females.

For better understanding, flatness coefficient (β_2) was also computed. Based on values from Tab.2., one can say that flatness was more or less present in all the measurements except II with females, and VII when its highest value prevailed in both sexes.

More information about surveyed parameters was provided computing the lower, upper and inter-quarter difference (Tab.2).

The lower quarter (Q_{25}) represents lower bounds of the lower-data-half, bordered by minimum value on one side and by median, on the other. The values increased in the upper quarter with each next measurement analogously to the increases in minimum and median values, i.e. broiler body mass.

The upper quarter (Q_{75}) represents upper bounds of the upper-data-half, bordered by median on one side, and by maximum value, on the other, with values in between. The upper quarter behaved analogously to the lower one, but with prevalence of higher values in males compared to females.

The bounds between upper and lower quarter determined the range, i.e. the value of inter-quarter difference, within which a half of the total number of the variants approximating the average and median, was distributed. With the exception to III measurement with higher difference found in females, all the other measurements confirmed a higher difference in males. The highest increase in inter-quarter difference occurred in II, compared to I measurement, i.e. sixfold in males and sevenfold in females, to gradually decerase with each new, and become the lowest between VI and VII measurement.

Further course of variability analysis included the range between the upper quarter and minimum, with the first fourth of the total variants in between, followed by the range between the lower quarter and maximum, with the second fourth of the variants in between, as well as by the relationship between the inter-quarter difference and variation range, i.e. variation interval.

Analysing variant distribution in the lower quarter between the minimum and lower quarter, one can notice fairly wide interval, particularly in females, being far wider than that of inter-quarter difference throughout all the measurements. However, in the case of males, this interval was found to overlap with that of the inter-quarter difference in I, then suddenly increased in II, III and IV, but decreased in V, VI and VII measurement, to visibly narrow compared to the inter-quarter difference interval.

In males, the upper quarter of the variants distributed between the upper quarter and maximum had a much narrower scattering interval, compared to that of the lower quarter. This was likely due to a much wider interval in males, compared to that of inter-quarter difference in III and IV measurement. Therefore, in cocks, the variants mainly distributed to the left, i.e. towards minus variants, were scattered at greater distances. In hens, scattering interval was narrower than that of inter-quarter difference in III and VII, but equal to that in I measurement, with an obviously higher scatter in the lower than that found in the inter-quarter interval during all the measurements. This is one more proof of mainly distributed variants to the left, though in a less degree than in cocks.

Finally, since the deviations between inter-quarter difference and variation width were only minor in all the measurements and both sexes, then the 3-4 times lower value of the inter-quarter difference than that of variation width, may demonstrate even better how great scatter of the variants occurred in both lower and upper quarter.

Conclusion

The analysis of growth increase in semi-intensively reared Hybro broilers showed high differences in body mass in all the variants, despite equal rearing and dietary conditions. However, such a striking variability cannot be attributed to the variation coefficent value, since it ranged within allowable boundaries. Not until the variability was thoroughly analysed calculating the lower, upper and inter-quarter difference, was it possible to discover highly concentrated broilers in the lower quarter, i.e. between the upper quarter and minimum, as well as in the upper one i.e. between the upper quarter and maximum. As the scattering of variants increased with body mass increase, so the inter-quarter difference increased with increase in variation width.

In addition to highly concentrated variants in the lower quarter suggesting rather poor fattening results, their expressed scattering denoting highly differing broiler growth, indicated that these chickens seemed entirely unsuitable for industrial slaughter and carcass processing. Whether or not semi-intensive breeding of the broilers, selected for intensive one, can be highly efficient for fattening results and brood uniformity, is still uncertain. Thus, a new and a challenging task for poultry science to create hybrids to fit in outlet rearing and perform selection aiming at as lower differences in broilers' growth as possible.

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ANALIZA STATISTIČKIH POKAZATELJA PORASTA BROJLERSKIH PILIĆA U POLUINTENZIVNOM SISTEMU DRŽANJA

-originalni naučni rad-

Bogosavljevic-Boskovic Snežana[1], I. Gajic [2]
M. Petrovic, V. Bogdanovic [2]

[1] *Faculty of Agronomy, Čačak*
[2] *Faculty of Agriculture, Beograd - Zemun*

Rezime

Cilj ovog rada bio je sagledavanje mogućnosti i opravdanosti korišćenja sadašnjih, dobro poznatih hibrida za poluintenzivan sistem držanja. U tom cilju vršena je analiza porasta brojlerskih pilića hibrida Hybro gajenih na poluintenzivan način. Naime, i pored vrlo sličnih sistema držanja i ishrane pilići su sa stanovišta porasta pokazali veliku neujednačenost. Ova varijabilnost se nije mogla sagledati samo na osnovu vrednosti koeficijenata varijacije iz razloga što je ista pri većem broju kontrola bila u prihvatljivim okvirima. Zbog toga, vršena je detaljnija kontrola varjabilnosti izračunavanjem, između ostalog, donjeg i gornjeg kvartila i inter kvartilne razlike. Sve ove analize pokazale su veliko rasejavanje varijanata, koje se povećavalo sa porastom telesne mase pilića.

Kako je veliki broj varijanata smešten u donjoj četvrtini, može se zaključiti da su i tovni rezultati u celini posmatrano bili znatno slabiji. Osim toga, izražena neujednačenost grla nije poželjna pri industrijskom klanju i obradi trupova zaklanih pilića. Iz ovoga jasno proizilazi da, sa stanovišta tovnih rezultata i ujednačenosti jata, za poluintezivan sistem držanja nije optimalno koristiti hibride selekcionisane za intenzivan tov. Prema tome, živinarska nauka je pred velikim izazovom formiranja hibrida prikladnih za gajenje u ispustima, odnosno pred potrebom da se efikasnom primenom selekcije uočene varijabilnosti znatno smanje.