POLYCULTURE OF BUFFALO HYBRIDS WITH CHANNEL CATFISH

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Abstract: Bigmouth buffalo (BM) (*Ictiobus cyrinellus*) × black buffalo (BL) (*I. niger*) and BL × BM were compared with BM parentals when reared in polyculture with channel catfish (*Ictalurus punctatus*), grass carp (*Ctenopharynogodon idella*), and largemouth bass (*Micropterus salmoides*) over a 2-season period. All buffalo were 1 year old when stocked and 2½ years of age at harvest. All other fish were yearlings when stocked. Stocking rates per hectare were 2500 catfish, 30 grass carp, 100 bass and 250 buffalo. At harvest, catfish averaged slightly over 1 kg each, while bigmouth, BL × BM, and BM × BL hybrids were 2.86, 2.93, and 2.14 kg, respectively. Grass carp averaged 3.33 kg each for all combinations. Highest catfish yields and greatest total fish production were achieved in the polyculture combinations. The polyculture stocking combination with bigmouth buffalo was best with BL × BM next. The monoculture yield was lowest, even when just catfish production was compared.

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Buffalo fish production, as a farm crop, is at least 30 years old in Arkansas. During the 1950's, most buffalo were harvested in conjunction with multiple species (polyculture) fish farming, usually on an extensive basis. Their popularity decreased during the 1960's as intensive commercial channel catfish (monoculture) farming increased. Buffalo, as well as several other scale fish, share the common problem of separation or sorting difficulty associated with large commercial catfish harvests. They also have suffered from marketing and distribution limitations.

Bailey et al. (1978) documented a 31% decrease in total acreage devoted to intensive food fish production from 1972 to 1975 in Arkansas. However, this trend reversed during the latter half of the 1970's with a renewed interest in buffalo fish production both alone and in polyculture with catfish (Freeze and Henderson 1980).

Giudice (1964) presented the original data on buffalo-hybrid/catfish polyculture and strongly suggested their use whenever possible. Perry and Avault (1975) have also attested to the increased benefits of buffalo and buffalo hybrids reared in polyculture with catfish. Therefore, our objectives were to (1) further compare monoculture catfish production with polyculture of catfish, buffalo, grass carp, and bass; and to (2) evaluate the black and bigmouth hybrids with the parental bigmouth buffalo in similar combinations.

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METHODS

During April 1979, 12 0.1 ha ponds were stocked with triplicated combinations of channel catfish, bigmouth buffalo, black buffalo × BM hybrids and reciprocals, grass carp, and largemouth bass. In these combinations, the primary variable was the kind of buffalo used. Buffalo combinations were either BM × BL, BL × BM or BM parentals. All catfish averaged 36 g when stocked. Bigmouth buffalo were 1 year old when stocked and averaged 113 grams each. Buffalo hybrids were produced at the Fish Farming Experimental Center, Stuttgart, Arkansas, during the Spring, 1978. The hybrids, although the same age class when stocked, averaged 36 and 173 g, respectively, for the BM × BL and BL × BM crosses. Bass averaged 8 g, while grass carp were 555 g. Stocking rates per hectare were 2500 catfish, 250 buffalo/hybrids, 100 bass, and 30 grass carp. The grass carp were added to monoculture ponds for vegetation control, but recorded separately for yield comparisons. Total numbers and individual weights were recorded by pond for each species at harvest, except in the case of catfish only total weights were obtained.

During the 1979 production season, catfish were fed 3% of their estimated body weight 5 days each week. During the same period in 1980, 2% of their body weight was fed 3 times weekly. A 32% protein ration formulated as sinking pellets was fed both seasons. Food conversion efficiency (FCE) was calculated for the catfish in each of the 4 stocking combinations. Catfish were sampled once in November of 1979, to obtain weight estimations for feeding purposes.

Buffalo combination comparisons were conducted utilizing the Statistical Analysis System (SAS) for analysis of variance.

RESULTS AND DISCUSSION

At harvest, all catfish averaged slightly over 1 kg each, while the bigmouth, BL × BM, and BM × BL hybrids were 2.86, 2.93, and 2.14 kg, respectively. Grass carp averaged 3.33 kg each.

Catfish survival was 11% lower (73%) in monoculture than in polyculture ponds (84%). Snake predation during the 1st season was believed to be the primary cause for catfish losses. Fingerling catfish, in monoculture, apparently were more vulnerable to snakes, especially at feeding time, than in ponds with other fishes present.

Although catfish were stocked at a low density, "broken back" fish were observed in the 3 monoculture ponds with an incidence level of 40% for 1 pond. "Broken back" in catfish may occur due to lack of adequate vitamin C in prepared rations fed to confined catfish, although usually only when stocked at densities higher than used (Lovell and Lim 1978). No "broken back" fish were observed in any polyculture ponds presumably because these catfish had access to a combination of several forage fishes (buffalo reproduction) which supplemented their diet. Due to storage problems, the vitamin C level was apparently low in the commercial ration.

Significantly higher catfish yields and greater total fish production were achieved with the polyculture combinations. The bigmouth buffalo combination produced

slightly higher total yields. However, there were no significant differences among the buffalo combinations for average daily gain, final harvest weights, or survival. Monoculture yields were significantly lower, even when catfish production alone was compared (Table 1). The major factor contributing to greater catfish yields in polyculture appeared to be due to an abundance of forage fishes. This factor would also account for the better FCE of catfish in all of the polyculture treatments. Total net fish yields ranged from 1920 kg/ha for monoculture ponds to 2890 kg/ha for the BM buffalo polyculture ponds. An average of 2720 kg/ha was harvested from polyculture ponds versus 1920 kg from the monoculture ponds. Largemouth bass spawned in 7 out of 9 ponds, thereby adding the additional benefits of sustained yearling bass production for undesirable sunfish control as well as recreational fishing (Newton et al. 1978). Bass recruitment was approximately 220 fish/ha.

Table 1. Net fish production harvested after a 2-year period in 0.1-ha ponds at UA-PB, Pine Bluff, Arkansas.

Fish combinations	Channel catfish (kg)	Catfish feed conversion efficiency	Buffalo (kg)	Grass carp (kg)	Large-mouth bass (kg)	Total yield per pond (kg)
Bigmouth buffalo	220A[a]	1.97	60A	8A	1	289A
Black × bigmouth hybrids	195A	2.22	63A	8A	3	269A
Bigmouth × black hybrids	194A	2.21	52A	8A	3	257A
Monoculture	182B	2.38		10A		192B

[a] Means followed by different letters are significantly different at the 0.05 level.

Giudice (1964) found that the cross of the female BL and the male BM buffalo grew faster than either parent and attributed the additional growth to hybrid vigor. In our study, the male BL × female BM hybrid cross production was greater than either the bigmouth parentals or the BM × BL reciprocal (Table 1). The parental BM buffalo were more prolific in spawning than were the hybrid buffalo. Fingerling buffalo were observed and/or recovered from 2 BM ponds, while only 3 fingerlings were recovered from 1 pond with the BL × BM hybrids. Therefore, when all of these factors were considered, the BM buffalo combination appeared to be the most satisfactory for polyculture with channel catfish at the present time.

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