



Morphometric and meristic study of four freshwater fish species of river Ganga

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ABSTRACT

The present study was carried out in Ganga River from Devprayag to Haridwar district of Uttarakhand to analyse morphometric measurement and meristic count of some selected fish species during April 2017 to March 2018. Specimens (20) of each fish species were collected from different zones of river Ganga and 24 morphometric measurements and eight meristic count parameters were studied for each fish species. The total length and weight of *Cyprinus carpio* ranged from 14–18 cm and 60–78 g; Mahseer fish species 21–28 cm and 120–185 g; 20–26 cm and 100–160 g (*Labeo rohita*) and 17–25 cm and 20–34 g (*Xenentodon cancila*) respectively were recorded during the study period. The regression coefficient 'b' shows higher growth rate with respect to Total length. It was maximum in case of standard length (b= 1.115) and lowest in pelvic fin length (b=0.146) for *Cyprinus carpio*, maximum in case of standard length (b=1.132) and lowest in pectoral fin length (b=0.126) for Mahseer, maximum in case of Fork and standard length (b=0.995) and lowest in length of caudal peduncle (b=0.135) for *Labeo rohita* and maximum in case of standard length (b=1.020) and lowest in case of pelvic fin length (b=0.018) for *Xenentodon cancila* respectively.

Key words: Fish species, Ganga river, Meristic parameters, Morphometric

Ganga River is the perennial river of India, and combination of the two streams Bhagirathi and Alaknanda at confluence point Devprayag. Bhagirathi River originates from the ice caves of Gaumukh of gangotri glacier in the western part of Himalaya while Alaknanda originates from the Mana Pass, Badrinath (NRCD 2009). *Cyprinus carpio* (common carp, linnatus, 1758) is a fresh water fish and distributed in streams, river, lake, canals, ponds, ditch, ox-bow lake. Common carp is mainly food fish in the entire world because of the fast growth rate, omnivore's habitat (Weber *et al.* 2010; Ram *et al.* 2015). Mahseer (*Tor tor*; Hamilton 1822) is a food and game fish and it's found in mountain streams and fast flowing rivers in the plains and also found in stony or rock bottoms of swift flowing water and total length of fish was reported 150 cm and maximum weight of 68 kg (Shresth 1997; Talwar and Jhingram 1991). *Labeo rohita* (Rohu; Hamilton, 1822) is a middle dweller carp species found as the natural inhabitant of streams, river, lake, canals, ponds, ditch, ox-bow lake and other similar water bodies (Ashokan *et al.* 2013). *Xenentodon cancila* (Needle fish; Hamilton, 1822) common name freshwater garfish found in inhabitants of rivers as well as ponds, canals and inundated fields (Talwar and Jhingram 1991). Morphometric and Meristic study of fish species is an important tool for exact identification of the species with

the help of measurement of the length, weight, counting of fins, counting of spines, and other parameters (Cavalcanti *et al.* 1999).

MATERIAL AND METHODS

Study area: The study was carried out in the long stretch of Ganga Riverine system. In present study, four sampling zones were selected at an average of about 120 km. Morphometric and meristic parameters were studied for selected 4 fish species. Sampling Zone A, Devprayag (30°08'45.41"N, 78°35'47.44" E) to Shivpuri (30°08'09.75" N, 78°23'18.56" E) at an average of 55 km; Sampling Zone B, Shivpuri (30°08'09.75" N, 78°23'18.56" E) to Rishikesh (30°04'32.97" N, 78°17'21.56" E) at an average of 11 km; Sampling Zone C, Rishikesh (30°04'32.97"N, 78°17'21.56"E) to Haridwar (29°57'16.80"N, 78°10'48.12" E) at an average of 29 km; Sampling Zone D, Haridwar (29°57'16.80" N, 78°10'48.12" E) to Bhogpur (29°46'10.23" N, 78°11'24.44" E) at an average of 25 km.

Sample collection: Present research work was aimed to study different morphometric and meristic parameters in selected 4 different sampling zones in Ganga River from April 2017 to March 2018. 20 specimens of 4 species (*Cyprinus carpio*, Mahseer, *labeo rohita* and *Xenentodon cancila*) were collected from the Ganga River at 4 different sampling zones. The fish sample was collected from all the zones with the help of locally hired professional fisherman and fish anglers. Fish sample were collected with gill nets (mesh size 2.5 × 2.5 cm; 3 × 3 cm; 7 × 7 cm; length ×

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breadth = 75 × 1.3 m; 50 × 1 m), cast net (mesh size 0.6 × 0.6 cm), and drag nets (Mahajal). Fish samples were also collected from the nearest fish market. At all zones, the gill net was used at least 10 times and cast net used 20 times in each zone covering about 100² meter of river segment allowing 3–5 minutes settling times in each cast. The collected fish samples were preserved in 10% formalin and stored into the specimen jar to study the morphometric and meristic parameters, (20 specimen) for 4 selected fish species. The selected Morphometric and meristic parameters measurements were measured with the help of electronic balance (Wensar weighing scales limited, model no. PGB 200), digital vernier calliper, and meter tape etc. All measurement and counts of each species were taken in the laboratory as per Day (1875–78), Talwar and Jhingran (1991) and Jayaram (2010). The weight of all fish samples in gram (g) and morphometric parameters measured in centimeter (cm).

Statistical analysis: Statistical calculation such as Mean, Standard deviation, regression equation and correlation coefficient have been calculated for all the 4 fish species.

Regression equation for Morphometric Parameters: The formula has been applied for regression method on various Morphometric Parameters as follow:

$$Y = a + b X$$

where X is the total length; Y is the various Morphometric variables such as fork length, Standard length, Pre-dorsal length etc; ‘a’ is the constant value and ‘b’ is the regression coefficient.

RESULTS AND DISCUSSION

Present research work was focused on Morphometric and meristic parameters during April 2017 to March 2018. 20 preserved specimens of each fish species *Cyprnius carpio*, Mahseer, *Labeo rohita* and *Xenentodon cancila* were measured for morphometric and meristic parameters analysis. During the study, 24 Morphometric parameters and eight meristic counts of each fish species from the Ganga River were measured. All the Morphometric parameters of *Cyprnius carpio*, Mahseer, *Labeo rohita* and *Xenentodon cancila* revealed a proportional increase in total length of fish under study shown (range and mean±S.D. value) in Table 1. The range and mean±S.D. values of Morphometric characters, viz. weight of specimen, total length, fork length, standard length, pelvic fin length, pelvic spine length, pectoral fin length, caudal fin length, pre-dorsal length, pre-anal length, pre-pectoral length, pre-pelvic length, length of dorsal fin base, length of anal fin base, dorsal fin length, upper jaw length, lower jaw length, length of caudal length, body depth, maxillary barbell, snout length, eye diameter, head length, depth of caudal peduncle were observed for all 4 selected fish species of Ganga river in different zones. The meristic counts of *Cyprnius carpio*, Mahseer, *Labeo rohita* and *Xenentodon cancila* including dorsal fin ray, anal fin ray, caudal fin ray, pectoral fin ray, pelvic fin ray, lateral line scale, above lateral line scale, below lateral line scale were observed. The value of meristic counts of all the fish species are shown in Table 2.

The Morphometric parameters showed proportional

Table 1. Morphometric measurements of selected fish species from Ganga River (Mean±SD)

| Morphometric Measurements | <i>Cyprnius carpio</i> | | Mahseer | | <i>Labeo rohita</i> | | <i>Xenentodon cancila</i> | |
|---------------------------|------------------------|------------|-----------|-------------|---------------------|-----------|---------------------------|------------|
| | Range | Mean±SD | Range | Mean±SD | Range | Mean±SD | Range | Mean±SD |
| Weight (g) | 60–78 | 69±8.0 | 120–185 | 152.5±24.61 | 100–160 | 130±22.12 | 20–34 | 27±5.10 |
| Total Length | 14–18 | 16±1.52 | 21–28 | 24.5±2.58 | 20–26 | 23±2.21 | 17–25 | 21±3.01 |
| Fork Length | 12.7–17 | 14.75±1.59 | 17.5–25 | 21.25±2.86 | 19–25 | 22±2.20 | 164–24.5 | 20.45±3.02 |
| Standard Length | 11.2–16 | 13.6±1.73 | 16.4–24.2 | 20.3±2.94 | 18–24 | 21±2.20 | 15.7–24 | 19.85±3.08 |
| Pelvic Fin Length | 1.5–2.1 | 1.8±0.22 | 2.5–3.9 | 3.2±0.55 | 2.5–3.5 | 3±0.38 | 0.2–0.35 | 0.275±0.06 |
| Pelvic spine length | 1.5–2.1 | 1.8±0.22 | 2.5–3.9 | 3.2±0.55 | 2.5–3.5 | 3±0.38 | 0 | 0 |
| Pectoral fin length | 2–3.3 | 2.65±0.48 | 3–3.9 | 3.45±0.33 | 3–4 | 3.5±0.38 | 0.8–1 | 0.9±0.07 |
| Caudal fin length | 2.5–3.4 | 2.95±0.33 | 5–5.9 | 5.45±0.34 | 4–5.5 | 4.75±0.58 | 1–1.5 | 1.25±0.18 |
| Pre-dorsal length | 5.7–6.4 | 6.05±0.31 | 8.5–10 | 9.25±0.55 | 6–7.5 | 6.75±0.56 | 11–19 | 15±2.92 |
| Pre-anal length | 9–10 | 9.5±0.40 | 11–16 | 13.5±1.74 | 10.5–13.5 | 12±1.15 | 11–19 | 15±2.92 |
| Pre-pectoral length | 3.4–3.8 | 3.6±0.16 | 4–5.5 | 4.75±0.59 | 3–4.2 | 3.6±0.45 | 6–6.5 | 6.25±0.18 |
| Pre-pelvic length | 6.1–6.8 | 6.45±0.27 | 8–12 | 10±1.50 | 7–8.5 | 7.75±0.57 | 7–16 | 11.5±3.46 |
| Length of Dorsal fin base | 5.7–6.4 | 6.05±0.31 | 2–3.5 | 2.75±0.56 | 4–5 | 4.5±0.37 | 1.8–2.6 | 2.2±0.29 |
| Length of anal fin base | 1.1–2.1 | 1.6±0.42 | 1–2 | 1.5±0.36 | 0.7–1.3 | 1±0.23 | 2–2.9 | 2.45±0.34 |
| Dorsal fin length | 2–2.9 | 2.45±0.35 | 4–5.3 | 4.65±0.47 | 3–4.5 | 3.75±0.57 | 1–1.5 | 1.25±0.18 |
| Upper jaw length | 2.95–3.75 | 3.35±0.33 | 2–3.5 | 2.75±0.56 | 1.6–2.5 | 2.05±0.34 | 5–5.6 | 5.3±0.23 |
| Lower jaw length | 2.2–2.8 | 2.5±0.25 | 1–2.3 | 1.65±0.45 | 1–1.9 | 1.45±0.07 | 5.7–6.2 | 6.66±0.19 |
| Length of caudal peduncle | 3–3.95 | 3.475±0.39 | 4.2–5.3 | 4.50±0.41 | 2.4–3.2 | 2.8±0.31 | 0.1–0.3 | 0.2±0.07 |
| Body Depth | 6–7.2 | 6.6±0.52 | 6–7.5 | 6.75±0.53 | 6–7.5 | 6.75±0.56 | 1–1.4 | 1.2±0.15 |
| Maxillary barbless | 2 pairs | 2 pairs | 2 pairs | 2 pairs | 1 pair | 1 pair | 0 | 0 |
| Snout Length | 1.2–1.9 | 1.55±0.29 | 1–2.5 | 1.75±0.55 | 1–1.9 | 1.45±0.34 | 3–3.6 | 3.3±0.23 |
| Eye diameter | 1.1–1.9 | 1.5±0.31 | 0.7–1.2 | 0.95±0.18 | 0.14–0.3 | 0.22±0.06 | 0.1–0.5 | 0.3±0.16 |
| Head Length | 4.2–4.9 | 4.55±0.36 | 3.5–4.9 | 4.2±0.52 | 2.1–3 | 2.55±0.34 | 4–5.2 | 4.6±0.46 |
| Depth of Caudal Peduncle | 2–2.98 | 2.14±0.40 | 2–3.5 | 2.75±0.56 | 1–1.9 | 1.45±0.20 | 0.5–0.9 | 0.7±0.15 |

Table 2. Meristic counting of selected fish species from Ganga River

| Counts | Abbreviation | <i>Cyprinus carpio</i> (Range) | Mahseer (Range) | <i>Labeo rohita</i> (Range) | <i>Xenentodon cancila</i> (Range) |
|--------------------------|--------------|--------------------------------|------------------|-----------------------------|-----------------------------------|
| Dorsal fin ray | DFR | 21(3–4/18–20) | 12(3/9) | 14–16(3/11–13) | 15–16 |
| Anal fin ray | AFR | 8(3/5) | 8(2–3/5) | 7(2/5) | 17–18 |
| Caudal fin ray | CFR | 3/17–19 | 19 | 19 | 15 |
| Pectoral fin ray | PFR | 15 | 19 | 17 | 10–11 |
| Pelvic fin ray | PEFR | 8 | 9 | 9 | 6 |
| Lateral line scale | LLS | 33–37 | 22–26 | 40–42 | 0 |
| Above Lateral line Scale | ALtr | 5–6 | 4 _{1/4} | 05–07 | 0 |
| Below lateral line scale | BLtr | 5–6 | 2 _{1/2} | 05–07 | 0 |

positive increase with increase in the length of fish. Ujjania *et al.* 2012 also observed the positive growth recorded in Morphometric parameters with increase in fish length. The meristic counts were almost constant in all the length groups of fish with different body length, so it concludes that the meristic counts were independent of body length (Talwar and Jhingram 1992; Zafar *et al.* 2002). On comparing growth rate relationship of selected fish species, Morphometric parameters in relation to total length was maximum in case of standard length ($b=1.115$) and lowest in pelvic fin length ($b=0.146$) for *Cyprinus carpio*, maximum in case of standard length ($b=1.132$) and lowest in pectoral fin length ($b=0.126$) for Mahseer, maximum in case of Fork and standard length ($b=0.995$) and lowest in length of caudal peduncle ($b=0.135$) for *Labeo rohita* and maximum in case of standard length ($b=1.020$) and lowest in case of pelvic fin length ($b=0.018$) for *Xenentodon cancila* respectively (Table 3). Higher correlation coefficient

‘r’ indicated positive correlation in case of various Morphometric with the Total length (Table 3). For *Cyprinus carpio*, correlation coefficient ‘r’ was maximum between total length and fork length ($r=0.995$) and lowest between total length and caudal fin length ($r=0.961$) showing the positive correlation with total length. For Mahseer, correlation coefficient ‘r’ was maximum between Total length and caudal fin length ($r=0.993$) and lowest between total length and head length ($r=0.944$) showing the positive correlation with total length. For *Labeo rohita*, correlation coefficient ‘r’ was maximum between total length and fork length and standard length ($r=0.998$) and lowest between total length and length of caudal peduncle ($r=0.938$) showing the positive correlation with total length. For *Xenentodon cancila*, correlation coefficient ‘r’ was maximum between total length and fork length and standard length ($r=0.999$) and lowest between total length and pectoral fin length ($r=0.915$) showing the positive

Table 3. Regression equation of Morphometric parameters of selected Fish from Ganga River (P=0.05)

| Parameters | <i>Cyprinus carpio</i> | | Mahseer | | <i>Labeo rohita</i> | | <i>Xenentodon cancila</i> | |
|---|------------------------|-----------------------------|---------------------|-----------------------------|---------------------|-----------------------------|---------------------------|-----------------------------|
| | Regression equation | Correlation coefficient ‘r’ | Regression equation | Correlation coefficient ‘r’ | Regression equation | Correlation coefficient ‘r’ | Regression equation | Correlation coefficient ‘r’ |
| Fork Length (Y) on total length (X) | $Y=1.045x-1.802$ | 0.995 | $Y=1.101x-5.500$ | 0.984 | $Y=0.995-0.904$ | 0.998 | $Y=1.001x-0.579$ | 0.999 |
| Standard Length (Y) on total length (X) | $Y=1.115x-4.012$ | 0.982 | $Y=1.132x-7.224$ | 0.986 | $Y=0.995x-1.904$ | 0.998 | $Y=1.020x-1.492$ | 0.999 |
| Pelvic Fin Length (Y) on total length (X) | $Y=0.146x-0.552$ | 0.985 | $Y=0.208x-1.923$ | 0.96 | $Y=0.169x-0.940$ | 0.984 | $Y=0.018x-0.100$ | 0.972 |
| Pectoral fin length (Y) on total length (X) | $Y=0.311x-2.320$ | 0.972 | $Y=0.126x+0.307$ | 0.981 | $Y=0.169x-0.440$ | 0.984 | $Y=0.022x+0.413$ | 0.915 |
| Caudal fin length (Y) on total length (X) | $Y=0.215x-0.474$ | 0.961 | $Y=0.129x+2.257$ | 0.993 | $Y=0.255x-1.217$ | 0.963 | $Y=0.059x+0.035$ | 0.953 |
| Dorsal fin length (Y) on total length (X) | $Y=0.232x-1.245$ | 0.989 | $Y=0.178x+0.261$ | 0.969 | $Y=0.254x-2.160$ | 0.984 | $Y=0.059x+0.026$ | 0.974 |
| Length of caudal peduncle (Y) on total length (X) | $Y=0.253x-0.594$ | 0.965 | $Y=0.157x+0.838$ | 0.965 | $Y=0.135x-0.392$ | 0.938 | $Y=0.024x-0.304$ | 0.979 |
| Head Length (Y) on total length (X) | $Y=0.236x+0.679$ | 0.980 | $Y=0.195x-0.688$ | 0.944 | $Y=0.150x-0.972$ | 0.973 | $Y=0.150x+1.455$ | 0.990 |

correlation with total length. Badkur and Prashar 2015 also found the positive correlation for different Morphometric parameters with respect to total length of Mahseer (*Tor tor*) in River Narmada. Similar observation was made by (Nautiyal and Lal 1988, Bhatt 1997, Johal *et al.* 2003) while studying analysis of Morphometric and meristic characters of *Tor putitora* from Gobindsagar reservoir and Ganga River between Rishikesh and Haridwar. Various environmental factors influence Morphometric character of fish species, i.e. thermal factor (Period of incubation) Barlow 1961 and Gould 1956). Tanning (1944) also observed that unpaired fin and rays number in various species also change with respect to moment of water at various density. Various author reported that hydrographic condition may also lead to variation in body proportion (Hubbs 1922 and Barlow 1961). So, the Morphometric and meristic counts of freshwater fish of Ganga River show that the proportional growth rate of fish species increasing with increase in fish length and show a higher positive correlation with the total length. Meristic counts were found to be constant. There may be some limitations which estimate that all measurements were obtained based on formaldehyde preserved specimens after 10–20 days of fixation. The change in the total length as well as total weight of the preserved specimen in formaldehyde is due to shrinkage and partial dehydration.

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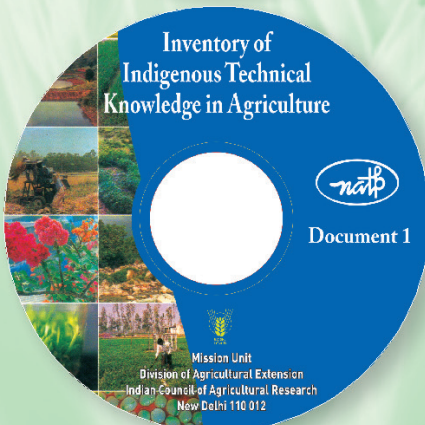
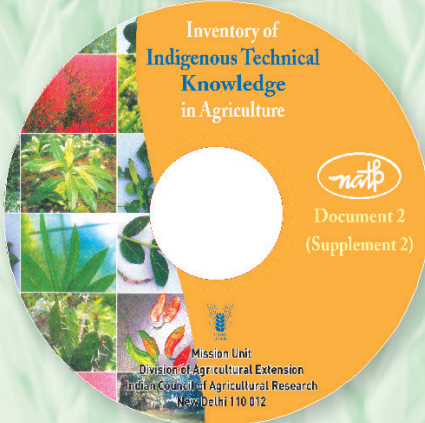
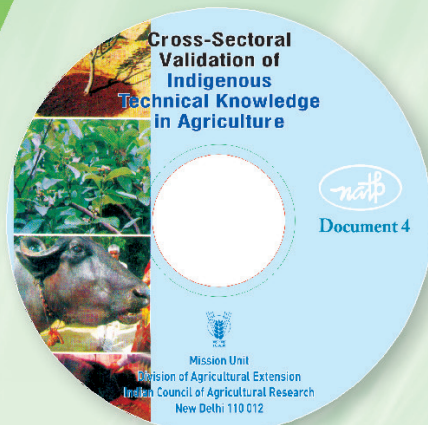
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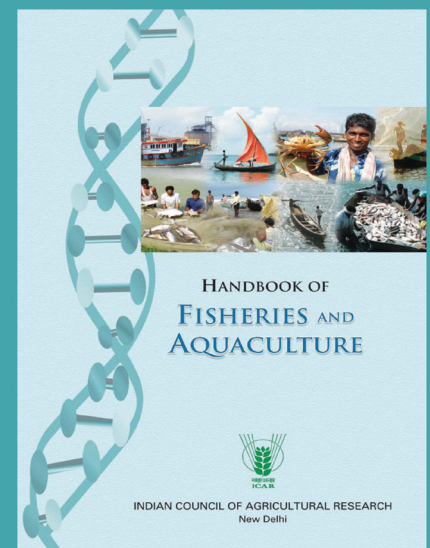
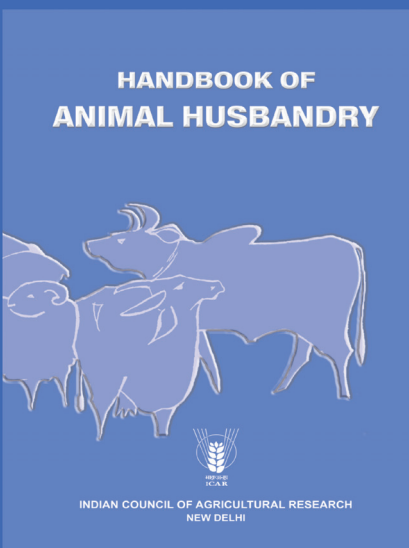
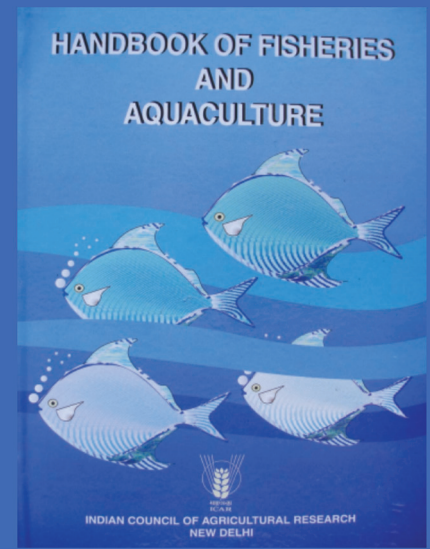
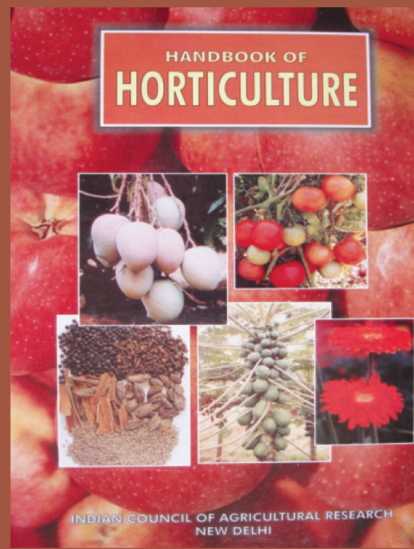
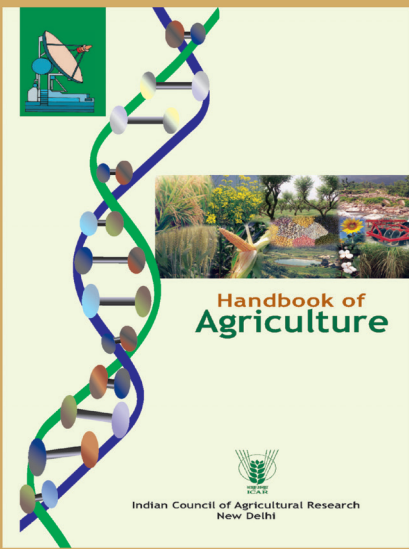


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